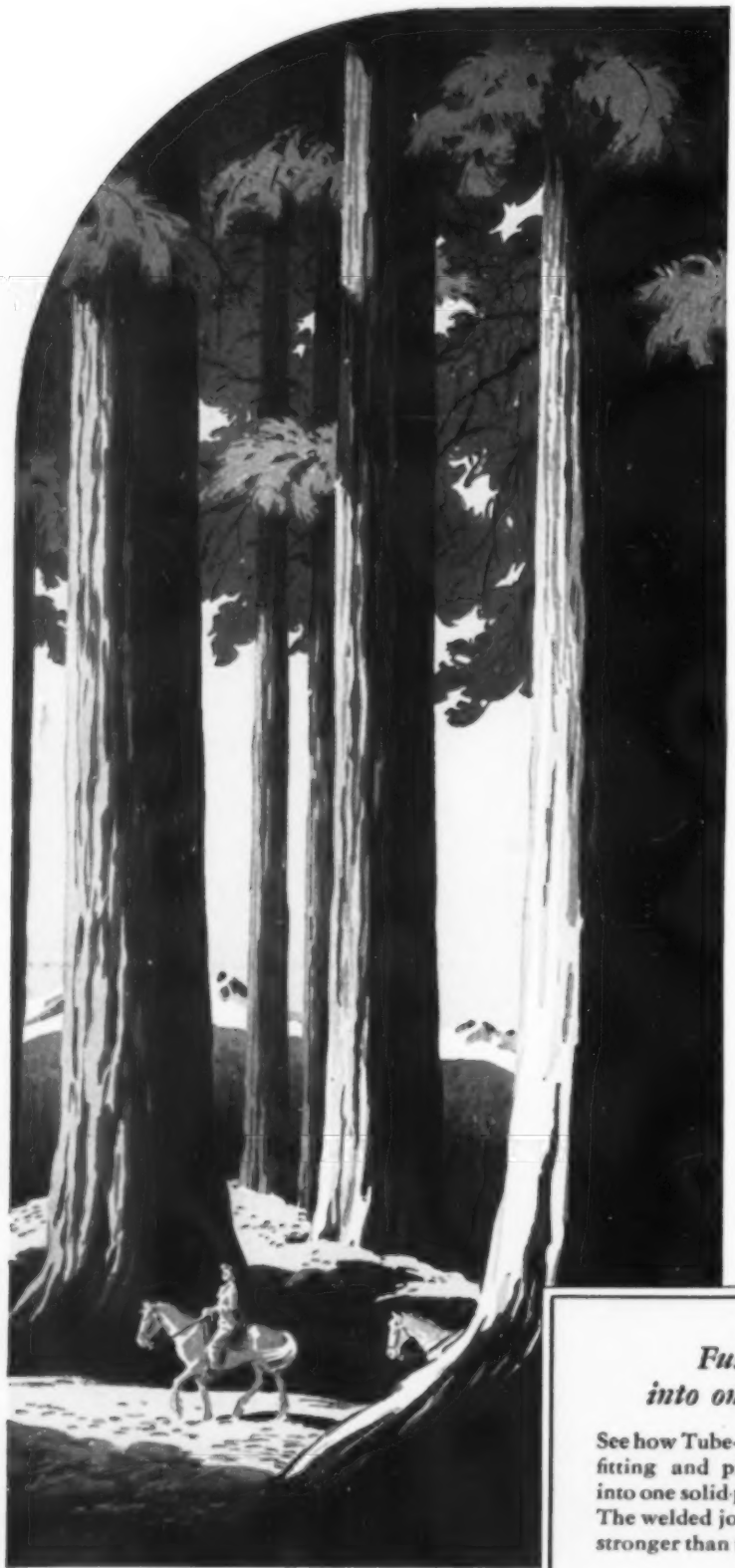
CHEMICAL & Metallurgical ENGINEERING

For APRIL, 1945

• PAINESVILLE MAGNESIUM OPERATIONS ARE UNIQUE IN MANY RESPECTS • GLYCERINE DISTILLATION GREATLY IMPROVED BY HIGH VACUUM • HUMPHREYS SPIRAL, ANOTHER TOOL FOR PROCESS INDUSTRIES • NEW ANALYSIS PROVIDES FORMULA TO SOLVE MIXING PROBLEMS • WHAT IS AHEAD IN MANPOWER AND LABOR RELATIONS

These stone mills grind slowly but exceedingly well in a Newark paint plant



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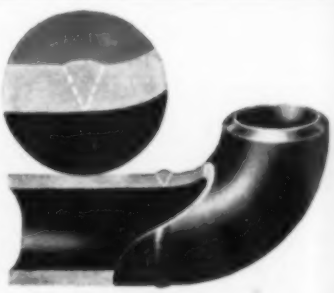

TUBE-TURN TRADE MARK *Welding Fittings and Flanges*

CHEMICAL & METALLURGICAL ENGINEERING

APRIL • 1945

Volume 52 Number 4

Cover Picture
Stone mills grinding paint at the Newark, N. J., plant of Pittsburgh Plate Glass Co.

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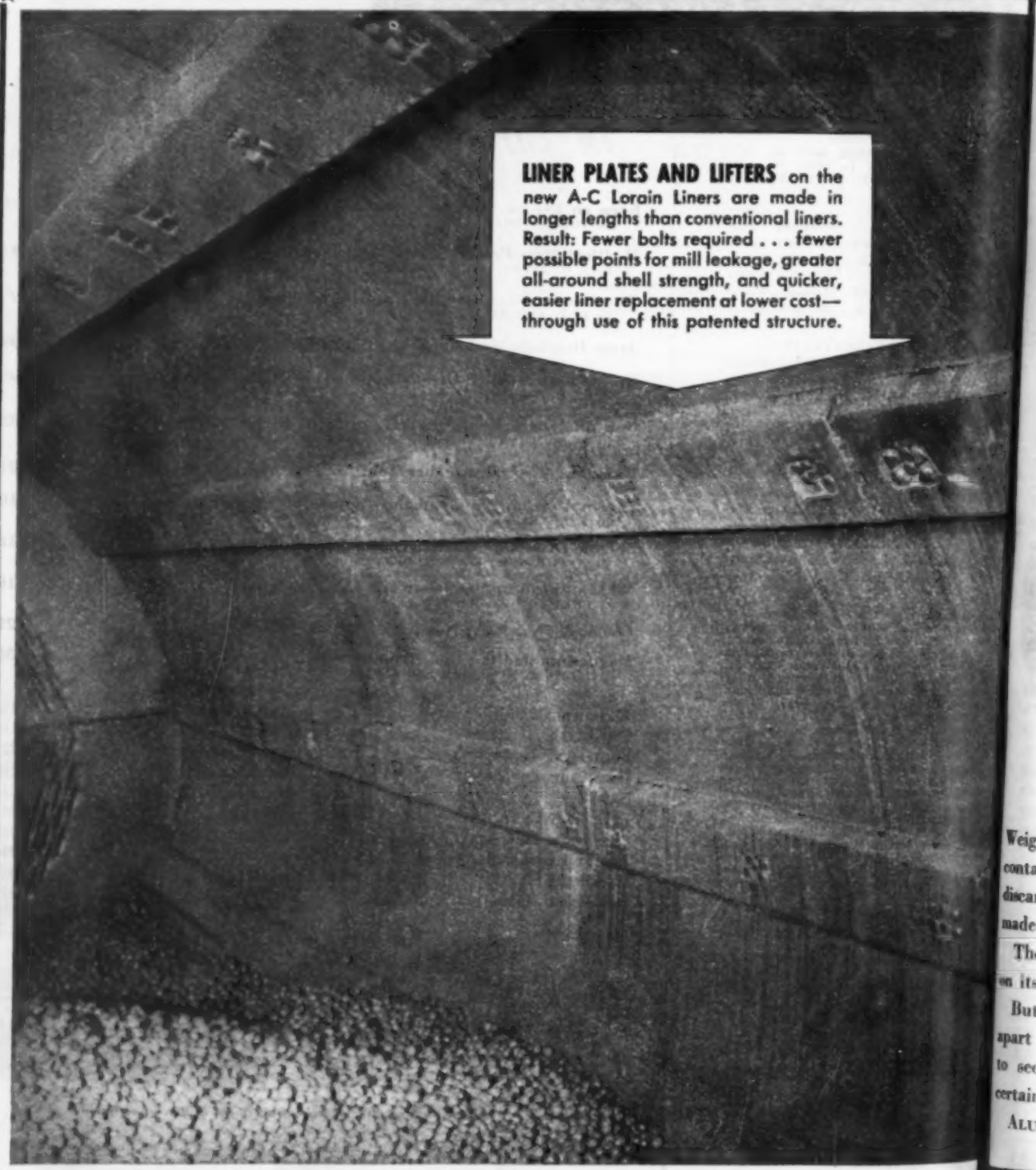
PRODUCT OF THE MONTH


LINER PLATES AND LIFTERS on the new A-C Lorain Liners are made in longer lengths than conventional liners. Result: Fewer bolts required . . . fewer possible points for mill leakage, greater all-around shell strength, and quicker, easier liner replacement at lower cost—through use of this patented structure.

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A "one-trip" Alcoa Aluminum Drum came home to report after six trips over the Hump . . .

Cut in half for inspection, the inside surface of this aluminum drum was found to be in excellent condition.

Weighing only 21 pounds instead of the usual 52 pounds for a container of this capacity, this aluminum drum was designed to be discarded after delivering gasoline over the Burma hump. But it made six return trips — plus an 800-mile truck trip.

Then it came home to report. Visible evidence of hard usage was on its rolling rings. They showed signs of heavy service.

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ALCOA FIRST IN ALUMINUM

ALCOA ALUMINUM

WATCHING WASHINGTON

R. S. McBRIDE, Editorial Consultant • PAUL WOOTON, Chief of McGraw-Hill Washington Bureau • MALCOLM BURTON, Washington Correspondent

Congress plans stock piles of strategic and critical materials. Tariff Commission estimates postwar consumption of magnesium. American Farm Bureau Federation adopts fertilizer policy. New Civil Service policy criticized. John L. Lewis wants new leverage on chemical manufacturers. Facilities for production of phthalates increased, but meanwhile supply of phthalic alkyd resins has become acute. Dutch prepare to ship natural rubber to United States shortly after V-J Day. Prospects for increased pulp and paper are not good. Hydrofluoric acid is no longer bottleneck in making aviation gasoline that it was formerly. Underground storage of helium is arranged

STAND-BY PLAN PROMISED FOR AMMONIA PLANTS

SYNTHETIC ammonia plants in the United States will be indefinitely idle if the implications of a State Department assurance to Chile are realized. However, such result seems highly improbable. The obvious purpose of these promises made during the course of the Inter-American Conference on Problems of War and Peace at Mexico City was to encourage Chile to continue Latin-American cooperation with the United States. Naturally Chile fears that the future opportunity for sale of nitrate in the United States will be very slim if the government plants are operated effectively for fertilizer manufacture. But it is not clear on what basis an assurance could be given by the Secretary of State that these establishments would be maintained for national security only.

The proposals of the State Department are definitely contrary to the proposals of the Department of Agriculture which has urged extensive production of fertilizer in these government-owned plants. Farm organizations will undoubtedly fight any plan to keep them idle. Labor will be equally opposed to such destruction of jobs for the benefit of Chilean workers. And certain members of the Senate will immediately ask as to what authority permitted the decision of these policy matters by the State Department, apparently in direct conflict with surplus property disposal legislation.

Delivery of natural sodium nitrate to the United States has recently been at prices higher than the actual cost (with profit) of synthetic sodium nitrate made in this country. When the lower cost of ammonia which is now possible at government plants is taken into account it is obvious that the State Department proposal would greatly increase the cost of fertilizer nitrogen. Furthermore the natural nitrate is not suitable for mixed fertilizer use, but the ammonia from the government plants is.

The exact wording of the pledge made to the Government of Chile that the United States would retain the plants in standby condition appears in the State Department's Press Release No. 293 of April 5.

STOCK PILE POLICY

STOCK piles of strategic and critical materials for national defense will be built according to a policy proposed in legislation introduced the middle of March, if the Administration carries out its plans. The bill introduced in identical form in House and Senate creates a Stock Pile Board made up of the Secretaries of War, Navy, State, Interior, and Commerce. That Board would acquire and control present surplus property and would add more supplies in order to meet the general requirements for an adequate military reserve.

GOVERNMENT OWNED PATENTS

THE research policy of all of the major research agencies of the government are described briefly in reports made by each bureau and department which has been engaged in any of the government's wartime research and development activities during 1940 to 1944. The individual reports have been published by the Senate Committee on Military Affairs which made this inquiry.

Probably most valuable to industrial groups is the description of the patent policy which each of the various agencies has established for its own staff. These policies vary widely from some which forbid private exploitation to others which encourage or almost compel it. (Those desiring the document can procure it from Superintendent of Documents, Washington 25, D. C., by asking for Senate Subcommittee Report No. 5 from the Committee on Military Affairs, S. Res. 107, at 40c. per copy.)

POSTWAR MAGNESIUM NEED

AFTER a thorough investigation of the magnesium industry a special report was prepared by U. S. Tariff Commission in which the demand to be expected for magnesium in the postwar period was estimated. The most significant part of the forecast was as follows:

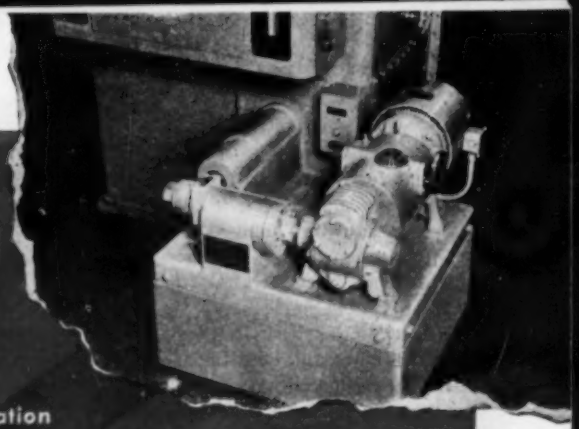
"It seems likely, however, that even in the immediate postwar years consumption will be much greater than before the war. improvements in the production and fabrication of the metal now allow many applications which before the war were considered impracticable.

"Estimates of consumption immediately after the war generally range from about 30 million to over 100 million pounds a year. Although no forecast can be made with any degree of certainty, fairly reasonable estimates may be made on the basis of past experience, wartime developments, and the expressed plans of potentially large consumers of magnesium. Such estimates, which may probably be regarded as maxima for the first few years after the war, are shown below; the actual consumption may readily prove to be much lower, and possibly somewhat higher."

	Million Pounds
Automobiles and trucks (5 lb. per unit for 5 million units)	25.0
Aircraft (average of 500 lb. per unit for 20,000 units)	10.0
Railway equipment, trailers (highway), bicycles, motorcycles	5.0
Water transport	0.5
Portable tools and office equipment	10.0
Aluminum alloys	10.0
Deoxidizers and scavengers	2.0
Miscellaneous	2.0
Total	64.5

FERTILIZER ECHO

APPARENTLY taking its cue from the Department of Agriculture, American Farm Bureau Federation has adopted a national fertilizer program. This powerful farm lobby group urges that U. S. Department



Stepless VARIABLE SPEED operation

offers tremendous advantages on many applications. You, yourself, probably have several applications on which variable speed operation would improve the quality of the product and increase the quantity of production as well.

For example, look at this oxygen generator which produces from ordinary air, absolutely dry oxygen that is at least 99.5% pure. This Speedranger provides stepless variable speeds so that pure oxygen and only pure oxygen is pumped off. Provides a high uniform quality product at peak production rate.

But look more closely at this variable speed drive. It incorporates not only the variable speed unit, but also a gear reduction to give speeds in exactly the right range, and an explosion proof motor. All of these . . . the explosion proof motor, the variable speed unit, and the gear reduction . . . all are standard Master units that easily combine into one compact, integral power package. Saves ordering and mounting time . . . saves space . . . saves money.

Probably you will not need exactly this same combination, but Master Speedrangers are available for every current specification, every type enclosure, with gearheads, unibrakes . . . and in the whole wide range of types in the Master line . . . in fact, is the most flexible, the most versatile line of variable speed drives in the world.

The next time you need a drive for material processing, handling, and conveying equipment; mixers and agitators; welding positioners; machine tool drives; testing and calibrating equipment . . . to name only a few . . . see what a really remarkable job Master Speedrangers can do for you.

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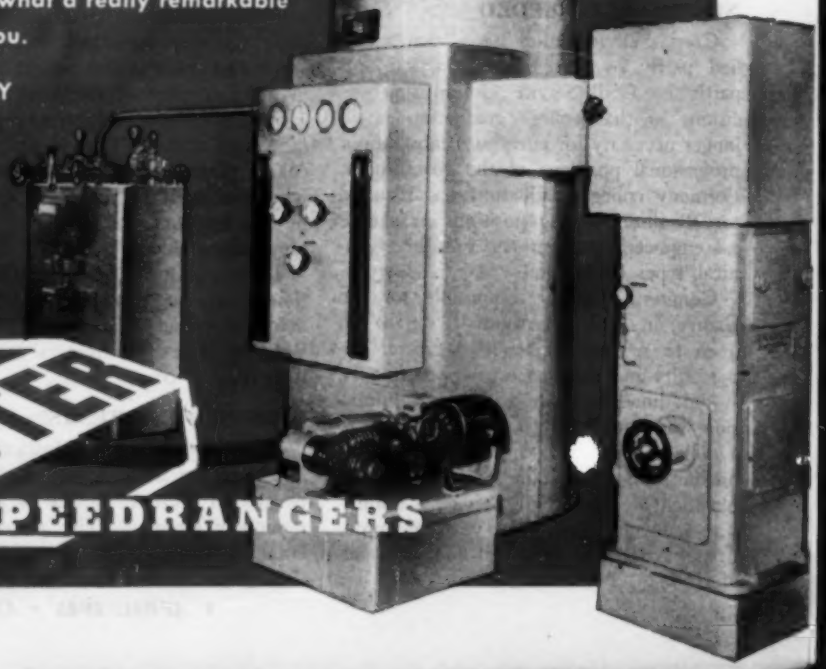

MASTER SPEEDRANGERS

of Agriculture be made the agency of the government for development and marketing of fertilizer and fertilizer materials. It uses very nearly the same estimates of future fertilizer need as were proposed by the department committee. (*Chem. & Met.*, March 1945, p. 82.)

The federation believes that the committee advisory to the department should be made up exclusively of bona fide farmers and land grant college representatives, without representation of the fertilizer industry. It suggests federal loans through the department to assist farm cooperatives and the organization of three regional companies which would process raw materials and distribute them through cooperatives. Thus the federation would complete the socialization of the business of fertilizers even more fully than did the committee report of the department.

DEEPER TARIFF CUTS

THE ADMINISTRATION plan for postwar tariff adjustment has taken definite form in a request that the President not only have continued authority to adjust tariffs by 50 percent up or down, but also that this authority be extended to permit changes of as much as 75 percent. The State Department in a national radio hookup did not emphasize these percentages. But it did undertake to defend reductions in tariff. It argues that only two or three million persons are engaged in industries "which might have been in danger from foreign competition without tariff protection."

The department did not explain that this is between a quarter and a third of the total employment in manufacturing industries. It compares instead this modest number with the total of gainfully employed of all classes. Washington observers rather expect that the President will be granted increased authority for tariff adjustments.

NO COLLEGE NEEDED

CIVIL SERVICE rules have been modified partly by Congressional action and partly by Civil Service Commission decisions so that college graduation is no longer necessary for entry into most junior professional positions of the government. Formerly college graduation was required for all those seeking positions in chemical engineering, chemistry, or other technical types of jobs.

Congress is partly responsible for the change in policy because it sought to open to returning veterans a greater opportunity and preference in appointments. It did, however, leave with the Commission the authority to determine where a college course was an essential part of qualification for junior professional employment. The Civil Service Commission has ruled that three years of appropriate experience or a full four-year college course may be used to qualify an applicant. Government executives are protesting vigorously on the ground that this will not bring adequately qualified workers for the positions.

VITAMIN LIMITATIONS

PUBLIC Health Service and other federal agencies are now taking a new attitude on vitamin additions to foods. Such additions are being somewhat discouraged in order that more "natural" foods be made available to the general public. More emphasis is being placed on keeping the natural vitamins in foods by proper processing. Restoration of vitamins inevitably destroyed during canning, freezing, or drying is not discouraged. But fortification to usually high standards is being frowned on more and more.

It looks as though anyone wishing to add vitamins to foods in the future will have to make a very convincing demonstration of the public service value of the specific program before they can "get by" with any such additions. Those who make vitamins by chemical synthesis will have to take account of this new public relations policy if they are to get and hold markets that appeared formerly to be open readily to them.

UNION-MADE EXPLOSIVES ASKED

A LITTLE-NOTICED proposal of the United Mine Workers in their discussions with coal mine operators was a provision that would require the mine owners to furnish only union-made tools and union-made explosives. Thus John L. Lewis and his organization are undertaking to force unionization in other industries. It would be very welcome to United Mine Workers if this scheme were to give its District 50 by this means a new leverage on chemical manufacturers. It should be recalled that the most aggressive chemical union is this District 50 of UMW.

Important, but apparently even less emphasized, is another proposal which would give similar leverage. It would make the wage agreement include a provision that mine workers might cease work in order to prevent shipment of coal to a consumer whose employees are engaged in a legal strike. Thus a steel works or coking plant might be shut down readily by a mine workers' strike. It would have no relation to mine workers' own employment problem.

These and many other coal labor questions may be temporarily settled even before this issue of *Chem. & Met.* is read. But the issues will remain active for a long time to come.

"MISUSE OF PATENTS"

THE DEPARTMENT of Justice is urging in Congress a more drastic regulation and penalty to prevent "misuse of patents by monopoly groups." The proposed legislation would make a patent at once invalid if a company owning the patent were convicted of monopolistic action. This Department of Justice has offered to rewrite proposed legislation in order to clarify the language in accordance with these principles.

The admitted purpose is to make it easier to control practices which are alleged to be violations of anti-trust laws by threatening to cancel patent rights of companies so accused. The Department of Justice also seeks authority to intervene in any private litigation of a patent in order to assist a company charged with infringement. The purpose here also is to encourage newcomers by making it more difficult for patent owners to protect themselves. The bill in question is H.R. 97 proposed by Representative Voorhis.

PHTHALATE SHORTAGE

EXPANDED military requirements for phthalates has resulted in the authorization of additional facilities for the production of phthalic anhydride and also for more capacity of naphthalene, its principal raw material. Use of naphthalene for anything but the most essential civilian requirements has been prohibited. This is also true for the uses of phthalic anhydride. Effect of this is being felt in the production of printing inks.

In the meantime, the shortage of phthalic anhydride for resins has resulted in a reduction of allocations of alkyd resins with little hope for bringing suppl and requirements into balance in the near future. Changes in specifications may be forced on the protective coating industry as a direct result.

The supply situation of phthalic alkyd resins has become so acute that early in March WPB took steps to make full use of off-grade and obsolete inventories of this chemical for essential civilian needs. At the time WPB announced the new policy, it spelled out the information which should be included with requests for use of off-grade or obsolete inventories.

NATURAL RUBBER TO SURVIVE

WASHINGTON takes seriously the quasi-official statements of Dutch spokesmen regarding the future of natural rubber in the Netherlands Indies. During March the director of Netherlands Indies Rubber Research Institute, Dr. Pieter Honig, expressed his belief that war destruction will not long prevent renewal of natural rubber supply when the Japs have been chased out of Java.

A new group has been organized by the Dutch known as Rubber Centrale, an agency to be managed by directors important in the prewar industry. Private operation independent of government control will thus be re-established quickly. Dr. Honig gave a clear picture of certain policies and plans in the following language:

Properly Engineered Materials PLUS Skilled Application "Know-how"

TYGON
the chemically inert plastic

RUBBER
GRS or Neoprene

RESILON
hydrocarbon resin

ACID-BRICK and CEMENTS
Vitric-10 — Durisite

LEAD
sheet or homogeneous bonded

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They know that from the wide range of lining materials manufactured by U. S. Stoneware that we can suggest, without prejudice, the lining material best suited for a given job. They know that the skill and knowledge acquired through 80 years of leadership in fabricating corrosion-resistant materials and equipment is assurance of an application technique, an engineering "know-how" that means a better tank lining job no matter what material is used.

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"Fifteen million dollars' worth of rubber producing equipment, representing about 25 percent of what is normally required, has been purchased in the United States. The Netherlands Indies Government's relief purchases have been and will be financed out of its own funds. Our basic governmental policy is to provide the means, through soundly financed loans, to restore not normalcy but a condition where the population can help itself achieve it. We do not think the United States or anyone else should be expected to play Santa Claus to us."

Dr. Honig also stated that he believed that by 1955 the Netherlands Indies would be producing twice as much rubber as at the corresponding date after World War I. Part of the optimistic forecast made by this competent technical Dutch spokesman is based on the assumption that rubber consumption in postwar years will be much greater than in prewar years because of new uses, in sponge rubber for example. Thus the U. S. synthetic industry could continue and these Dutch estimates could also be true.

PAPER PROSPECTS

ALLOCATIONS of wood pulp for the first quarter of 1945 were 2,681,650 tons, while the allocation for the second quarter dropped off to 2,599,700 following the downward trend in pulpwood production which set in late last year. Department of Commerce figures show that the curve of production for pulpwood turned down last September and by December had reached a point 14 percent below December 1943. Inventories in December 1944 were also below the previous year in spite of total receipts for the year being more than 11 percent above 1943.

The long term view is for increased activity in paper making in contrast to immediate expectations for a continuation of the downward trend which will not be broken until production of pulpwood increases not only for the year but "in seasonally proportionate quantities each month."

DRUMS TO REMAIN SCARCE

BULK containers generally used by the chemical industry—multi-walled paper sacks, steel drums, and fiber drums—are scarce items and there is little hope that the situation will improve in the near future. Heretofore, the industry has been able to run to substitutes when any material or container became short. The time has now come when the country has no more fat to support such changes and there are no substitutes to which the industry in this country can turn in the present emergency.

Paper shipping sacks are in fair supply because the uses have been restricted sharply. Some slight relief may be afforded by the substitution of paper sacks for fiber drums. Aside from that, the only other practical solution is for the chemical industry to exercise the greatest possible economy in the use and reuse of all types of containers, particularly metal and fiber drums.

CONTAINER STANDARDIZATION

STANDARD specifications for a 55-gal. steel drum for handling petroleum products are expected to ease the problems of both the manufacturers and the users. With all government agencies concentrating on a single design, production probably will improve through longer runs. It will also cut the inventory problem of the refiners who in the past have had to stock special drums for each purchasing agency.

Standarization has already proved itself in other types of containers. In the case of fiberboard for boxes and drums, the problem was attacked on the assumption that a cord of wood ground into pulp would cover more than in the form of lumber. V-Board and the standard Army-Navy specifications resulted.

MINOR NEWS GLIMPSES

Hydrofluoric acid is no longer the bottleneck in making aviation gasoline that it was formerly. Non-essential users of fluorspar still get no acid grade mineral. But the war program is now adequately served.

Kerosene in drums by box car has been the expensive but effective method for giving New England a sufficient supply of that essential lighting and supplementary heating oil. The price, which would have been prohibitive if it had paid the full freight bill, has been kept within reason by having the extra transport charge paid by the government.

Canol project for producing petroleum above the Arctic Circle is being abandoned. Seemingly doomed to failure from the start, this undertaking of the Army is now being stopped. The inference is that the project never was any good; but there's no admission of that fact by General Somervill and other high Army authorities who made the decision for a start.

The billionth barrel of crude oil was processed in the Dutch refinery at Aruba during March. Petroleum Administrator Ickes took occasion to congratulate that Dutch enterprise on its huge contribution to the war program under difficult conditions. He thus emphasized the participation in the American fuel program of agencies outside of this country.

U. S. Supreme Court will review in part two suits against alkali export associations to decide whether these agencies, supposedly legal for export business, have been violating the anti-trust laws as charged by the Department of Justice. However, the initial review is limited to the propriety of immediate trials which might detrimentally affect the war effort of interested companies. This proceeding does have at least the effect of postponing immediate trial of the case on its merits, which is what the export associations sought in the lower courts some time ago.

Underground storage of helium is being arranged by the Bureau of Mines. Surplus production from gas that must be shipped out for public utility service was necessary and long-time storage was feasible only in some of the wells near Amarillo. Obviously long-time tank storage would have been impractical both technically and economically. Hence the surplus helium will be pumped back into wells from which it later can be recovered by reprocessing.

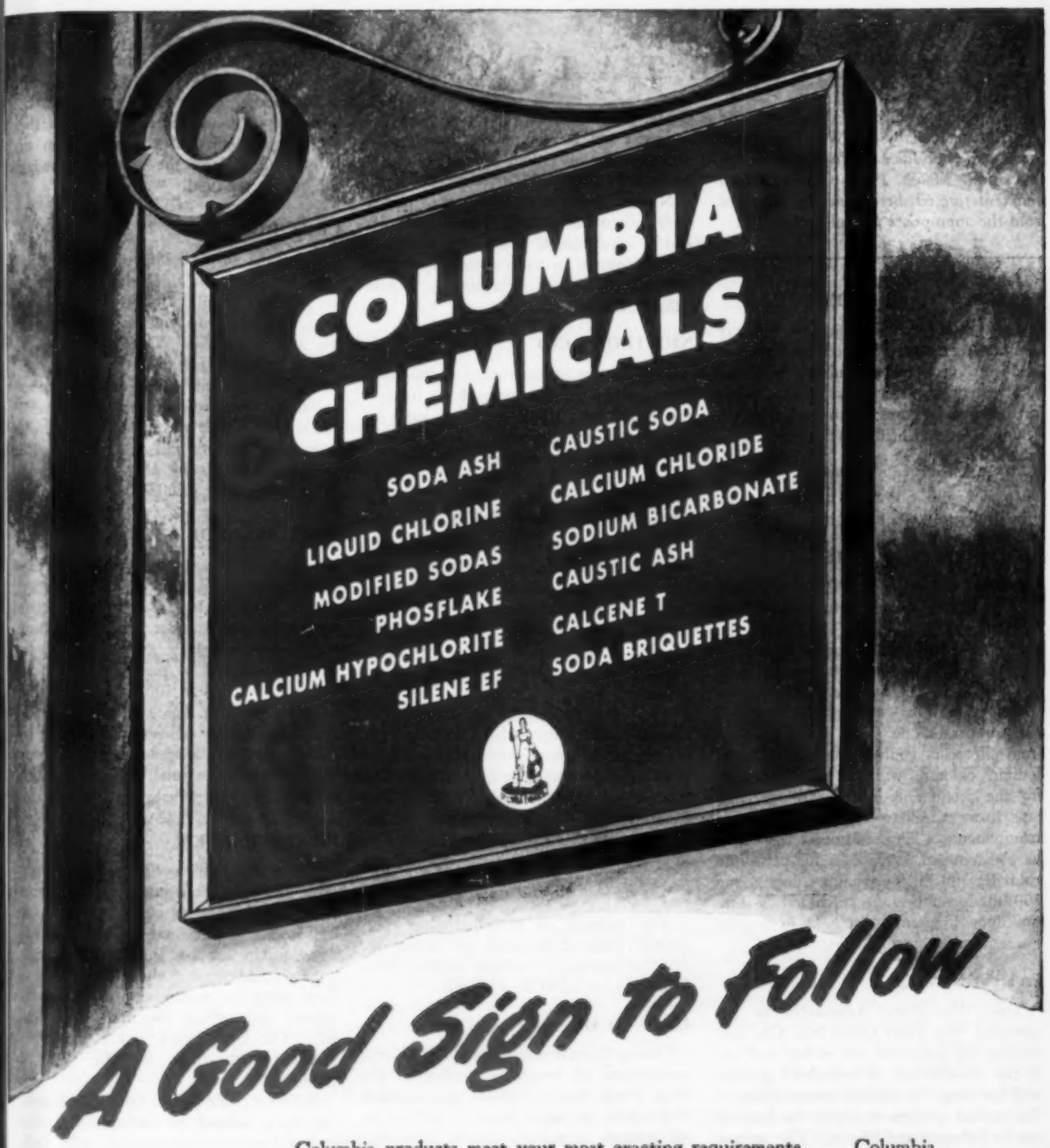
Regional credit pools will be utilized by Reconstruction Finance Corporation as a convenient local means for giving credit to small business needing postwar money. The local pools will make the loans and keep 25 percent of the risk. RFC will take up 75 percent of the loans and thus extend the local business dollar over four times as much business as would otherwise be possible.

Eight more "Valley Authority" agencies would be established to imitate TVA if some of the interested Congressmen are able to put through the legislation sponsored by Representative Rankin of Mississippi. Most pressed is the Missouri Valley Authority idea; but even that does not seem to have any good prospect of early establishment by Congress.

Increased use of fertilizer made in recent proposals greatly strengthens the emphasis on use of these materials for hay and pasture development. This strengthens the ideas which the fertilizer industry has undertaken to foster for some time. Apparently it is the first time that the government has begun to emphasize the need of increased fertilization on the relatively low-price feed crops such as hay and pasture.

Solutions of calcium chloride can be used to fill heavy-duty truck, tractor, and farm-implement tires. This development is being pushed by certain equipment builders because it gives better traction with less tire wear than is possible when air is the filling medium. Loss of inflation and excessive wear when operating tires not fully inflated are also troubles that are avoided.

Foremen's grievances must be promptly adjusted whether these workers are part of a union organization or not. National War Labor Board is insisting that such supervisory employees have a recognized program to adjust quickly complaints that arise in their own group. Specific suggestions of this sort have been made to a number of companies which are considering foremen as a part of management.



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Columbia products meet your most exacting requirements . . . Columbia policies contribute to enduring business relationships. Well located plants and excellent distribution facilities are other important factors in the selection of Columbia as your source of alkalies and related chemicals.

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COLUMBIA CHEMICAL DIVISION
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PHILADELPHIA • MINNEAPOLIS • CHARLOTTE • LOS ANGELES

INTERPRETATIONS

This installment covers orders, rules and regulations issued by the War Production Board and the Office of Price Administration during March, 1945. Copies of each item interpreted here may be obtained from the appropriate federal agency.

TALLOW AND GREASES

At a meeting of an industry advisory committee, recently formed to represent producers of inedible animal fats, announcement was made that ceiling prices for tallow and greases will not be changed. The meeting was held principally to clarify existing regulations as to color specifications, titer, and the question as to who is to defray the freight charges on returned empty containers.

CHLORATE CHEMICALS

By revoking Order M-171 and transferring chlorate chemicals to a new schedule under M-300, WPB has limited the definition of chlorate chemicals to include only potassium chlorate, sodium chlorate, and potassium perchlorate. The minor chlorates such as barium chlorate and barium perchlorate have been removed from allocation controls because sufficient sodium chlorate will be made available for the production of these minor chlorates to meet military and essential civilian requirements. The small order exemption has been raised to 250 lb. for potassium chlorate, 300 lb. for sodium chlorate, and 100 lb. for potassium perchlorate. This was done to permit shipment in a minimum number of containers.

FATS AND OILS

The War Food Administration has amended War Food Order No. 42b, continuing the permitted use of fats and oils in the manufacture of household package and bar soap for civilian consumption in the second quarter at about the level of use in February and March. The amendment also reinstated provisions which limit the soap inventories of industrial users to a 45-day supply.

GUM AND WOOD ROSIN

Because inventories of gum and wood rosin are at a very low point and production is expected to be affected adversely by manpower shortages, Order M-387 was issued to establish quotas for rosin that may be used in the production of all but preferred orders. Preferred orders are those that are for the Army, Navy, Marine Corps, Coast Guard, Veterans Administration, U. S. Maritime Commission, War Shipping Administration, War Food Administration, Bureau of Engraving and Printing, U. S. Government Printing Office, Panama Canal, Office of Scientific Research and Development, Foreign Economics Administration, or rated orders under P-65 and P-149.

Natural resins also have been placed under allocation control. Limited imports and a shortage of substitute materials brought about an unbalanced supply situation and made it necessary to impose delivery controls.

NICOTINIC ACID

Production of nicotinic acid has been large enough to take care of all requirements and with ample stocks on hand no future shortage is expected. Hence control over distribution has been suspended by revoking Schedule 1 of M-300.

TRANSFERRED TO M-300

Primary potash salts, including muriate, sulphate, sulphate of potash-magnesia, and run of the mine potash, have been removed from allocations order M-291 and placed under general chemicals order M-300. This action makes no change in allocations or authorizations to make delivery.

Tightened restrictions to safeguard increased military needs have followed the placing of trichlorethylene and perchlorethylene under the controls of M-300. Suppliers of perchlorethylene are now required to list by name on Form WPB-2947, all customers ordering more than 7,000 lb. a month. For those ordering less than 7,000 lb. a month, the quantities are listed by end use.

The quantity of trichlorethylene permitted without the need for listing individual customers has been reduced from 10,000 lb. to 3,250 lb. a month.

LINSEED OIL

Owing to current stringencies and future uncertainty of linseed oil supplies, the War Food Administration has amended WFO-42A to lower, from 50 percent to 40 percent of average use in 1940 and 1941, the amount of fats and oils that may be used for the manufacture of protective coatings, coated fabrics, and floor coverings for civilian consumption.

CARBON TETRACHLORIDE

Suppliers of carbon tetrachloride are now required to list on their consumption reports the names of customers ordering more than 3,500 lb. a month. Because of the severe shortage, this action was taken to provide closer controls over deliveries. Suppliers also are required to file a quarterly report of stocks and consumption. Each person who orders 21,000 lb. or more of carbon tetrachloride for delivery during the first quarter of 1945 or who orders 10,500 lb. or more for delivery during any subsequent quarter also must file with WPB on Form WPB-3442, a stock and consumption report for each quarter. These reports must be filed to reach the Washington office of the agency on or before the 15th of the month following the quarter reported.

UREA RESINS

In order to curb inflated requests for urea and melamine aldehyde resins which are in short supply, WPB will check all consumers' proposed use as well as past use and inventories. Consumers are required to apply for the resins on Form WPB-2945 instead of filing purchase order certificates of proposed use. Estimated production of urea and melamine aldehyde resins in February was about 7,000,000 lb. while requests for that month aggregated more than 9,000,000 lb.

AMYL ALCOHOL AND ACETATE

In order that producers of penicillin may be assured of ample supplies of amyl acetate, both amyl alcohol and the acetate have been placed under allocation control which supervised deliveries in April. Allocation was effected by placing these chemicals under Schedule 100 of M-300. The schedule provides that each supplier seeking authorization to use or deliver these materials shall file applications on Form WPB-2947. The small order exemption is 34 lb. in the aggregate per month.

PRICE CHANGES

Effective March 17, the base maximum price for ester gum containing gum rosin was increased from 11.5c. a lb. to 11.85c. a lb. The increase is intended to cover production cost plus freight out.

Seven additional trading locations have been listed for maximum prices for semi-refined and refined imported cottonseed oil. The amendment makes the prices identical with those for the domestic product.

Price for crude peanut oil at Los Angeles has been reduced to conform with that at San Francisco, namely 13¼c. a lb. f.o.b. mill.

Maximum prices for solros and limed rosin, which are processed from wood rosin, have been increased to encourage production. Price for solros increased from $3.90 to $4.10 per 100 lb.; prices for limed rosin to be the maximum for the grade of wood rosin being limed, plus from 20 to 30c. per 100 lb. depending on the percent of lime content.

Producers of high-tenacity rayon yarn are permitted to apply for price increases to cover higher production costs with converted or newly constructed equipment.

Cotton linters that have been rejected for chemical use now carry a maximum of 3.23c. a lb. for sales by cottonseed oil mills and 3.55c. a lb. for sales by dealers.

AMERICA WANTS PROSPERITY

A BOOK to be published early in April by the McGraw-Hill Book Company carries the provocative title "Prosperity: We Can Have It If We Want It." Its authors, Messrs. Shields and Woodward, state in vigorously challenging terms their conviction that the United States will emerge from war with human, material and technological resources adequate to provide a nation-wide standard of living unprecedented in world history. They present, too, their formulation of the several policies and procedures which must be followed by government, business, and labor if we are to realize our potential for a high and sustained prosperity unmarred by prolonged periods of severe unemployment and business stagnation such as have haunted our economic past.

The specific proposals set forth will elicit both enthusiastic acclaim and acrid dissent, for the book deals in far from gentle fashion with many of the currently fashionable panaceas for assuring prosperity by magic formula. It examines, and discards as effective guarantors of prosperity, whatever their individual merits upon other grounds, programs for public works, slum clearance, subsidizing of small business, foreign loans, social insurance, deficit government spending, redistribution of income, the numerous formulae for monetary management, repeal of the anti-trust laws, or any of the loosely-phrased admonitions that government should do nothing and allow everything to take its course untrammeled by controls of any kind.

On the positive side, the book urges clear recognition of the fact that prosperity, under a system of business enterprise, depends primarily upon the existence of competitive incentives that spur capital investment to provide better tools and equipment, that improve organization and technology to insure continuously increasing productivity per man-hour of work, and that enlarge markets by producing what the consumer wants at lower prices to the end that real incomes may be increased.

In short, prosperity depends upon profitable and expanding business and employment opportunity, so it becomes the part of enlightened government, business, agriculture and labor policy to promote those measures which will forward rather than retard the major aim of expanding production.

However great the room for dissent upon the adequacy, or the phrasing, of the specific recommendations it makes, the approach of this book has one virtue of solid merit. It attacks positively the problem of what steps should be taken to achieve and hold prosperity rather than merely devising a poultice to be applied when and if we run into a decline.

Virtually all responsible spokesmen for government, and for business, labor, and agricultural groups, are agreed upon the goal of prosperity. Moreover, they agree that, insofar as possible, it should be achieved through the effort of private enterprise, with government intervention utilized only as a last resort. But despite this unanimity, almost all public discussion of the problem has concentrated upon the nature, the extent, and the timing of such government expenditures as may be found necessary to combat deflation. Since upon this question there is far from general agreement, our procedure has created an exaggerated sense of divergence in a field in which, so far as fundamentals go, we all are in accord to quite an unusual degree.

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No confusion should be caused by the fact that the generally current phrase for prosperity is "full employment." The latter phrase merely states the goal in terms of human values, which are good terms in which to state any goal. What matters is that we generally are agreed as to what we mean when we say that we want prosperity or full employment. Not only do we know what we mean, but within very rough limits we can give dimension to our concepts. There are a few whose appraisals are somewhat lower, but most competent estimators set the goals for about 1950 at an average annual employment in civilian jobs of between 55 and 57 million persons, with a gross national product of between $185 and $200 billion measured at 1943 price levels. This contrasts with the 1944 level of non-military employed of 51½ million, and a gross output for the end of 1944 of over $200 billion. It assumes a reduction of the average workweek to 40 hours.

It will take some such levels as these to provide employment for those who seek work, with only sufficient "frictional" unemployment (those temporarily listed as unemployed because of the normal turnover between jobs) to afford reasonable labor-market flexibility to both workers and employers. The non-military employment figures are generally consistent with the officially stated postwar goal of jobs for 60 million workers, since the latter figure is generally understood to be an estimate of the *labor force,* which includes members of the armed services and an allowance for frictional unemployment.

There are a number of reasons why the estimates cannot be figured more closely, and why no one can be very confident even of the validity of the stated limits. The chief points of doubt in the employment estimates relate to how many withdrawals there are likely to be on the part of women, oldsters, and youngsters, who now are in the labor force to a number more than 6 millions beyond normal expectancy; how many men will be retained in the armed forces; and whether the

postwar frictional unemployment should be calculated as approximating the current 1 million or the 3 million so-listed in the prosperous year of 1929. Additional uncertainties cloud the estimates of gross national product. Notable among them is the fact that no one is sure of the war's effect upon man-hour productivity trends, in view of the fact that half of our current output has consisted of products that had no substantial counterpart in our peacetime price or production series.

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Nevertheless, despite such qualifications, it is fair to say that we do have a general conception of the magnitude of our postwar goals. Although they are well within our production potentials as demonstrated in this war, they are formidably beyond any previous record of peacetime achievement. Only the most sanguine optimism could lead one to expect that they will be achieved without concerted will, planning, and cooperative effort. Only blind recklessness could engender confidence that once attained they will automatically be held, let alone expanded in normally healthful growth.

If we were to follow past patterns, our war-built boom would, after a period of uncertain length, collapse into disastrous depression. The very magnitude of our recent growth would contribute to the depth and duration of the subsequent trough. Yet a fall even to the level of our previous peacetime-peak-year 1939, has been estimated by The Federal Reserve Board to imply unemployment for between 15 and 20 million persons. If human values have importance, that is something that must not be allowed to occur. If business values have importance, we must not tolerate again such losses as occurred from 1930 to 1933, when sales over the four year period were $128 billion less than would have been provided if the 1929 level had held, and corporate profits declined from more than $7 billions in 1929 to an average annual loss of $1 billion over the next four years. A repetition of these things cannot be tolerated—*if foresight and cooperative effort can prevent them.*

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In January of this year Senator Murray introduced in the Senate a bill entitled "The Full Employment Act of 1945." It instructs the President to submit to Congress plans for eliminating both unemployment and inflation, including recommendations for correcting structural defects in the economic system. It provides for a Joint Congressional Committee to consider the proposals of the President, to take testimony from experts and the general public on these proposals or any others it may wish to consider, and after weighing all the facts to submit its findings to Congress. It provides for an advance budgeting of the constituent parts of a full-employment economy, and commits the Federal Government to provide, in advance, for sufficient expenditures (through private contractor channels) to make up for the gap between estimated private expenditures and the amount necessary to assure full employment.

By no stretch of the imagination can The Full Employment Bill, in its present form, be regarded as acceptable to business. Yet it may well present a test of whether or not American business can deal with problems in this area in a statesmanlike fashion. Such statesmanship will consist in demonstrating first, that the Bill is not acceptable because of deficiencies which preclude the possibility of its accomplishing the avowed purposes; and second, that business is able and anxious to offer constructive suggestions for remedying these deficiencies.

It is easy to point to weaknesses in the Bill. To mention only a few of major importance: The proposal to make advance Federal expenditures to compensate for estimated deficiencies in prospective private expenditures is completely impracticable. No one in the country can predict future trends with sufficient accuracy for this purpose; no one can tell what the constituent parts of a really high, *stable* peacetime budget should be, for in our boom-or-bust economy we have no stable pattern to project; no one can tell, within reasonable limits, how much the government should spend *in advance* to assure full employment. The Bill pronounces labor's right to work without defining commensurate responsibilities which it should exercise. It does not define the areas of proposed government expenditure in such a way as to allay business fears of government competition or the general public suspicion of leaf raking. Above all, the Murray Bill is defective in that, despite a somewhat vague pronouncement in favor of forwarding private business activity, it recommends a single specific designed to supplement such activity rather than stimulate it.

The very definition of certain of these faults suggests their remedies. But the positive task of stating how the Bill should be amended in order that it may have effective usefulness is far from simple. Yet it is enormously to the advantage of American business to undertake it. Fortunately, there is a representative group sponsored by industry, The Committee for Economic Development, which has for some time been working intensively upon the problem, and which is excellently equipped to offer sound and progressive advice. It should be used for this purpose.

American business cannot afford to take a negative attitude toward legislation in this field. Some legislation undoubtedly will pass, for the problem is one in which there is a grave government responsibility. But equally there is a comparably important responsibility upon all citizen groups. None of them has more to gain or lose from the rise or fall of prosperity than American business.

President, McGraw-Hill Publishing Co., Inc.

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Keep an Eye on Mexico

WHEN this country entered the war in 1941, it was with the hope that our good neighbor on the south would at least maintain a sort of armed neutrality. She pleasantly surprised us by also declaring war on Germany and Japan and is reported to have an air force in the Pacific. At one time many industrialists believed that Mexico offered a rather unhealthy climate for American chemical enterprises. Lately we have had abundant reason to change our minds. Today, Mexico serves as an outstanding model of what can be accomplished through economic cooperation and partnership.

Consider first the part being played by our chemical industries and engineers in advancing the industrialization of Mexico. Armco International has built a new $10 million steel industry with Mexicans supplying capital and Armco technical information. Celanese is building a $5 million rayon plant, again on a partnership basis. Eight U. S. companies have cooperated in another cellulose development with its bonds guaranteed by the Mexican government. Cyanamid engineers are reported in charge of a great chemical project for recovering alkali products from Taxcoco Lake—an operation said to be patterned after the Dead Sea industries of Palestine. Johns-Manville and U. S. Plywood are also mentioned in the industrial news from south of the Rio Grande.

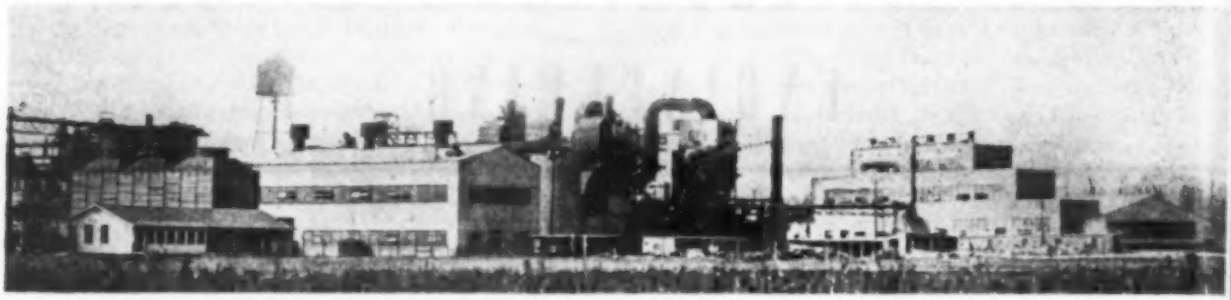
The Mexican-American Commission for Economic Cooperation, organized in 1943, has just made its final report recommending in its immediate program some 20 projects costing $24 million, with a much larger postwar program of industrialization, irrigation and electrification. Details are not yet known here but the Commission received competent advice from U. S. technologists on programs for the development of the Mexican steel, rubber, cement, chemical, textile, sugar, alcohol, and pulp and paper industries. Its long-range program will require materials, equipment and chemical engineering services from the United States.

These varied projects, alone or in the aggregate, offer definite evidence of the sort of material progress and well-being we hope to see more prevalent in all of the Americas. Beyond this, however, is a less tangible but perhaps more important change in Mexico's attitude toward the United States. The Inter-American Conference on Problems of War and Peace held in Mexico early in March culminated in the history-making Act of Chapultepec which seems to have removed the last traces of resentment against the "Colossus of the North." All of the American republics, even Argentina, are now on record pledging their assistance and in turn requesting ours in the protection of their independence against aggression from any direction. Thus our half of the world is ready to fit its hemispherical defense into the broader world security plan which the United Nations hope to set up this month in San Francisco.

Assistant Secretary of State Will Clayton told the Mexico City conference that within a very few years after the end of the war we expect to see international trade among the Americans expanded far beyond its prewar totals although obviously below the war-inflated levels of the past 4½ years during which we have purchased more than $5 billion worth of raw materials and goods from Latin America. The very substantial dollar balances these countries have built up in the United States must be wisely used—not for luxuries, but for capital goods, tools, equipment and technical know-how—all for the raising of living standards in the Western Hemisphere.

Mexico with her 20 millions of people is second only to Brazil among our American neighbors. She is our nearest market to the south, the gateway to Latin America. Let's continue the good work of understanding and sympathetic cooperation in solving our industrial as well as economic and political problems.

J. M. AVERY and R. F. EVANS
Respectively, V. P. in Charge of Research and Development, V. P. and General Manager, Diamond Alkali Co., Painesville, Ohio



Diamond Alkali's calcium hypochlorite plant at Painesville, Ohio—by far the largest ever built

MODIFIED MgO PROCESS

Yields $MgCl_2$ and Calcium Hypochlorite

Necessity has mothered some ingenious inventions in her day, but seldom has more artful chemical engineering been displayed than in the conversion of Diamond Alkali's magnesia plant at Painesville, Ohio, to the production of magnesium chloride—with the subsequent recovery of magnesium-cell chlorine as calcium hypochlorite. Furthermore, to offset the high cost of electric power, the magnesium chloride process has been so dovetailed into the operation of an old ammonia-soda plant that the calcium chloride from one process provides chlorine for the other, while dolomite can be used as raw material for both. A flowsheet of the operations is shown on page 130.—*Editors*

MUCH has been written of the glamour of magnesium from sea water; the Aladdin-like creation of a huge magnesium plant in the Nevada desert using cheap hydro-electric power from Boulder dam; the marvels of the Hansgirg process for the electrothermal reduction of magnesium oxide by carbon; and the ferrosilicon process for producing magnesium from dolomite. This is the story of the production of magnesium by the electrolytic process, using steam-electric power supplied by a public utility, in a plant at Painesville, Ohio, 30 miles east of Cleveland. The story is not without interest, since it involves several unique developments that provide the answer to a question frequently asked: How is it possible to produce magnesium metal economically at a location such as Painesville?

Basically, the answer lies in making use of facilities already in existence for the production of soda ash, which makes it possible to manufacture magnesium chloride, the principal raw material, cheaply enough to offset the high cost of electric power. To this is coupled the successful conversion of byproduct chlorine into vitally needed calcium hypochlorite.

Source of magnesium for this operation is the enormous surface deposit of high-grade dolomite in the region south of Toledo, within reasonable freight haul of Painesville. This same geological stratum underlies the Painesville plant, but unfortunately at a depth of about 3,000 ft.—apparently too great a depth to permit underground mining to compete with the delivered cost of rock from surface quarries in other areas. The cost of dolomite obviously is an important factor, since the rock contains only some 12 percent magnesium (20 percent MgO) so that one dollar on the cost of stone means more than eight dollars in terms of its magnesium content, and more than that in terms of recoverable magnesium metal.

MAGNESIA FROM DOLOMITE

In the summer of 1941, the Diamond Alkali Co. was well along with construction of a plant intended for the commercial production of refractory and other grades of magnesia from dolomite. The process to be used was designed to take maximum economic advantage of existing plant and operations by making the production of magnesia tie in with the manufacture of soda ash in such a way as to make use of the lime (CaO) value of calcined dolomite. The process finally adopted after a lengthy research and development program has much in common with the old Clerc-Nihoul process, but includes certain innovations found to be necessary or advantageous. Essentially, the process is based upon the following series of reactions:

$$MgCO_3.CaCO_3 + (\text{heat}) \rightarrow MgO.\ CaO + 2CO_2 \quad (1)$$

$$MgO.CaO + 2H_2O \rightarrow Mg(OH)_2.\ Ca(OH)_2 \quad (2)$$

$$Mg(OH)_2.Ca(OH)_2 + 2NH_4Cl \rightarrow Mg(OH)_2 + CaCl_2 + 2NH_4OH \quad (3)$$

$$2NH_4OH + (\text{heat}) \rightarrow 2NH_3 + 2H_2O \quad (4)$$

Reaction (1) represents the calcining

This article is based on a paper prepared for the annual meeting of the American Institute of Mining and Metallurgical Engineers, which was scheduled for February, 1945, but canceled because of travel restrictions.

of dolomite to dolomitic lime. At Painesville this is done in vertical mixed-feed kilns in order to obtain high-strength tail gas (about 40 percent CO_2) for use in the ammonia-soda process. As will be seen later, this tail gas is also directly useful in the production of magnesium chloride. The fuel used is coke from our own byproduct coke plant at Painesville.

Reaction (2) represents the hydration of dolomitic lime under carefully controlled conditions to yield a product having the best physical and chemical properties for the ensuing operation.

Reaction (3) represents the selective reaction of hydrated lime ($Ca(OH)_2$) with NH_4Cl to displace ammonia and generate $CaCl_2$ while the $Mg(OH)_2$ remains substantially unaffected. This reaction is carried out in the ammonia stills of the ammonia-soda process, and in so doing the lime content of the dolomite is used to replace ordinary lime. This provides a credit against the process and is one reason for its economic success.

Reaction (4) represents in effect the completion of reaction (3) by the usual procedure of steam distillation of the reaction liquor to remove ammonia, which is returned to the ammonia-soda process.

The residue from reactions (3) and (4), known as the blowoff liquor of the ammonia stills, is essentially magnesium hydroxide slurry in a solution of calcium chloride ($CaCl_2$) containing a substantial fraction of unreacted salt (NaCl) from the ammonia-soda process. For the production of magnesia, the next step is to separate the $Mg(OH)_2$ by thickening and filtering, producing a filter cake for further processing to the desired type of refractory or other magnesia product.

THE SCHEME CHANGES

By the time Diamond's magnesia plant based on this process was nearing completion, pilot-plant study of the production of magnesium chloride from this same blowoff liquor was also nearly finished. In the summer of 1941, the United States was deeply committed to supplying "non-shooting" aid to our future Allies, and it required no great stretch of imagination to guess that we would shortly be in a "shooting" war ourselves. At that time one of the most obvious critical shortages of war materials was magnesium metal, and frantic efforts were being made by the predecessor of the War Production Board to find ways and means of increasing capacity for its production.

Information regarding Diamond's interest in this field reached Washington, and we, along with others, were asked to undertake a magnesium-metal project in behalf of the Government. At that time the Cleveland area, including Painesville, was one of the few industrial areas of the country that offered the possibility of large blocks of surplus electric-power capacity, the labor supply was adequate, and substantial use of existing facilities and services made possible a project of which the capital cost would be low. All that was needed was selection of a process for making magnesium, with the Diamond Alkali Co. in the position of being able to use either dolomitic lime, magnesia, or magnesium chloride as raw material.

After carefully weighing the merits and drawbacks of known processes based on these different raw materials, decision was taken to adopt the Dow electrolytic process based on magnesium chloride produced in our own plant by our own process. Necessary arrangements with Dow were completed by the Government, and in October, 1941, a contract was signed for us to build and operate in behalf of the Government a magnesium plant having a rated capacity of 36,000,000 lb. of metal a year. A subsidiary, Diamond Magnesium Co., was organized for this purpose, and ground was broken for the new plant in December 1941.

MAGNESIUM CHLORIDE

Meanwhile, completion of pilot-plant work on the magnesium chloride project was rushed, coincident with design of a commercial plant. The process finally adopted was based upon carbonation of the slurry made up of magnesium hydroxide and calcium chloride, previously described, according to the simple reaction:

$$Mg(OH)_2 + CaCl_2 + CO_2 \rightarrow MgCl_2 + CaCO_3 + H_2O \quad (5)$$

This reaction is well known, and can be carried out in such equipment as carbonating towers or turbomixers, the former method being adopted by the Diamond company. In this step, slurry from reactions (3) and (4) is used as is, after proper proportioning and preparation in setting tanks, the carbon dioxide required being obtained from reaction (1), i.e., the rich tail gas of the vertical lime kilns.

An interesting and economically important feature of this process is that the chlorine content of the magnesium chloride is obtained from cheap byproduct calcium chloride liquor from the ammonia-soda process. In most other plants producing electrolytic magnesium, this chlorine is derived from the byproduct magnesium-cell gas, either through conversion to hydrochloric acid followed by wet reaction with dolomite or magnesia, or by dry chlorination in the presence of carbon at high temperature. In either case, make-up chlorine from electrolytic cells is required. Chlorine was at that time, and has since remained, one of the "critical shortage" chemicals for war purposes, and this avoidance of a need for make-up chlorine was therefore a matter of real importance in connection with our project. It was also our hope, and that of Government authorities, that we might somehow devise a method for helping out the chlorine situation by making use of the byproduct cell gas for the production of chemicals needed in the war effort. As will be seen, this was successfully accomplished.

Reverting to the production of magnesium chloride, further processing after carbonation involves thickening and filtering to remove precipitated calcium carbonate, leaving a solution containing about 10 percent $MgCl_2$ and some salt (NaCl). This solution is then evaporated to about 35 percent strength for delivery to the magnesium plant, in the course of which most of the salt is precipitated and removed. After certain purification treatment, the solution is ready for conversion to cell feed.

This evaporation step, simple as it sounds, presented great practical difficulties. The solution is highly corrosive, and an extensive research program was necessary in order to find a satisfactory material for tubes and other evaporator parts. This problem was finally solved by the use of Inconel tubes. There are also certain side reactions possible, which can and do cause trouble in the evaporators unless suitable controls are exercised. However, these problems were all worked out satisfactorily, though not without tribulation, and the plant was ready to produce a satisfactory grade of chloride in time for the starting up of the magnesium plant.

This occurred in September 1942, nine months after ground was broken, and successful operation has been maintained continuously ever since. The Dow magnesium process has been described elsewhere* so fully and effectively that it seems unnecessary to burden our readers with that part of the Painesville operation. We therefore pass on to the problem of using the byproduct cell gas for war purposes.

HYPOCHLORITE FROM CELL GAS

In the Dow process about 40 percent of the chlorine evolved leaves the cells as HCl, the gases are heavily diluted with air, and considerable carbon dioxide is present. As far as we are aware, no use had previously been made of this gas other than to convert all of its chlorine content to dilute impure hydrochloric acid of low value, for which in our case no adequate market could be found. The problem was then to find some way of converting into a product useful in the war program, the free chlorine contained in the cell gases, amounting to 70 or 80 tons per day. This is equivalent to the capacity of a large electrolytic chlorine plant.

Studies based on this cell gas quickly indicated that it was unsuitable for dry chlorination or for most familiar chemical

* *Chem. & Met.*, November, 1941.

purposes. However, our studies were given both impetus and direction by a request from the War Production Board that if possible this chlorine should be converted into hypochlorite for decontamination of poison gas and general sanitation purposes. This was presented as an urgent requirement of the armed services, and the advantages of using otherwise waste chlorine were obvious because of the persistent critical shortage of chlorine. The economic advantage of the use of low-value chlorine was also an important consideration.

The difficulties were all too apparent, for it was necessary first to cool huge volumes of dilute cell gas, remove hydrochloric acid already present in the gas, and then somehow convert its remaining free chlorine content into hypochlorite in spite of the presence of considerable carbon dioxide, known to be a deterrent to efficient conversion to hypochlorite. These difficulties were magnified by the fact that the gas, containing only about 3.5 percent chlorine by volume, was actually so lean as to be classed properly as a tail gas rather than a raw material. It was, moreover, important to produce not just "hypochlorite," but a high-strength, stable, solid product at a reasonable cost and with minimum requirement of critical materials and equipment.

It was found that the gas could be cooled and stripped of HCl by countercurrent contact with cooled water in scrubbing towers already in existence. Research indicated that the chlorine could be absorbed from the stripped cool gas, without much adverse effect from carbon dioxide, by the use of special absorption towers of modified Pease-Anthony type. This type of scrubber was designed for the removal of dust from gases and has been used commercially for that purpose, but we believe this is its first application in the field of chemical absorption, where, judging from our results, it has a promising future.

A pilot-plant scrubber demonstrated that both caustic soda and lime slurry could be used in such absorption units to produce hypochlorite solutions efficiently and economically, with very low chlorine content in the tail gas. The next step was to tie this result in with some known method for producing solid, stable, calcium hypochlorite.

Theoretically, conversion of chlorine to hypochlorite may be expressed by the reactions:

$$2Ca(OH)_2 + 2Cl_2 \rightarrow Ca(OCl)_2 + CaCl_2 + 2H_2O \quad (6)$$

$$2NaOH + Cl_2 \rightarrow NaOCl + NaCl + H_2O \quad (7)$$

It is well known that the chemical instability of ordinary lime bleach is due, at least in large part, to the presence of $CaCl_2$, while sodium hypochlorite is so unstable that it cannot be used commercially in dry form. Some 15 years ago research workers discovered that stable dry bleach (essentially calcium hypochlorite) could be made by metathesis according to the reaction

$$CaCl_2 + 2NaOCl \rightarrow Ca(OCl)_2 + 2NaCl \quad (8)$$

in which unstable NaOCl from reaction (7) and the detrimental $CaCl_2$ from reaction (6) are converted into harmless NaCl and stable $Ca(OCl)_2$. In the interest of the war effort, this reaction was adopted as the basis of our further progress toward production of stable bleach of high available chlorine content. The process thus involved separate production of chlorinated lime and caustic soda solutions, and mixing these in suitable proportions to bring about reaction (8).

The next step was to produce a dry product, for which purpose spray drying was adopted following successful trials in a spray dryer of commercial size, using liquor made in pilot-plant absorbers at Painesville. The product, a fine powder containing more than 40 percent available chlorine, appeared to meet all specifications then known to us for use by the armed services.

On the basis of these pilot-plant results, we were requested to build, as an extension of the magnesium plant, a hypochlorite plant designed to convert to solid calcium hypochlorite as much as possible of the byproduct chlorine. This meant a capacity of about 120 tons of finished product per day—by far the largest hypochlorite plant ever built or probably ever contemplated. The process to be used, while old in a chemical sense, departed widely from previous practice and involved pioneering steps of a critical nature. For example, removal of salt from the sodium hypochlorite liquor presented a difficult problem, which was solved by field trials with a continuous centrifuge of commercial size. The design of spray dryers for so huge a capacity of a thermally unstable compound presented special problems. Final design called for three such driers, coal fired, each with an evaporating capacity of about 90 tons of water per day, drying the product to about 1 percent moisture content by direct contact with indirectly heated air. Tail gases are cleaned by conventional type Pease-Anthony scrubbers. It required considerable courage to build such a pioneering plant without elaborate pilot-plant study, but time pressed, and the decision to go ahead was taken along the lines of Farragut's famous, "Damn the torpedoes; full speed ahead."

An interesting feature of the program was the completion, well in advance of the rest of the plant, of one of the four full-scale absorption tower units, together with a pilot plant spray dryer. The purpose was two-fold—to turn out product in sufficient volume for field tests by the Army, and to train operators well in advance of commercial production. Thus final pilot-plant work and construction of the plant were telescoped into the same period of time.

Meanwhile, additional information regarding newly established specifications for the product was disclosed, and it became evident that the product would have to be altered somewhat both chemically and physically. Details of such requirements cannot be stated here, but they necessitated a further urgent research and pilot-plant study for the modification of the product itself to meet the new specifications of the armed services. This study was only just under way when the plant began commercial operation in June, 1944, with one of four absorption units and one of three spray dryers in use. To the credit of the designing engineers and suppliers of equipment, very little serious trouble developed, though the normal birth pains of a new plant, using a new process, producing a new product, were encountered.

Late in August, 1944, the plant was producing commercially, solid, stable calcium hypochlorite acceptable for certain purposes, and by January, 1945, equipment had been installed which so modified the product as to meet specifications for other uses. Thus successful conversion of the otherwise waste cell gas into a needed wartime product is an accomplished fact.

CONCLUSION AND ACKNOWLEDGEMENT

All in all, the magnesium operation at Painesville is thus not without interest. It is the only plant in which magnesium chloride is made from dolomite as an adjunct of the ammonia-soda process, and the only one in which the byproduct chlorine is recovered for use in the manufacture of another wartime chemical. Surprisingly enough, the over-all economics of the plant, in spite of the high cost of the public-utility power, are sound, at least for war purposes. What the future holds for such a plant in the postwar period is only a small part of the whole postwar problem—he would be bold indeed who would hazard anything more than a guess. Meanwhile, it has served its purpose as an aid to winning the war, and with that we are content.

The successful completion of this project is the result of cooperative effort by many chemists, engineers, executives and operating personnel under unusually trying conditions. The authors, finding it impossible to select individuals to whom special acknowledgment should be made, pay tribute to all those members of the Diamond Alkali Co. and the Diamond Magnesium Co. who by their efforts contributed to its success.

The Chemical Industry, Its Growth and Workers

PAUL E. ANDERSON

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In spite of tremendous growth, the chemical industry no longer occupies a preferred position as a high-wage industry. Postwar needs for the high type of labor required indicate that steps must be taken toward restoring job attractiveness to prospective chemical employees. Industry, government and unions are attempting to clarify the more than 5,000 job classifications and to solve overtime, promotion, incentive earnings and other problems.—*Editors*

WITHIN a quarter of a century, the American chemical industry has risen from the smallest of industries to the position of a leader in the world. The 1944 output of the industry (Chemical and Allied Products Group) was $8.3 billions according to the WPB-Census data. This amount is 2¼ times the value of the 1939 production and puts the industry in a preeminent position.

Since 1939, $1,500 millions have been spent on the construction of new facilities. Of this sum, $500 millions is reported to be allocated to the production of butadiene, styrene, neoprene and catalysts in the synthetic rubber program. About $150 millions is to be spent during the year 1945 on the actual construction of new facilities of various types.

Taking this phenomenal record and the prospect of continued expansion into consideration, the production trends for the industries are on the upward grade. The demand for industrial and many other chemicals continues to be heavy and great. There is also a vast backlog of postwar demand. Long run prospects seem to be favorable. For the chemical industries, excluding explosives and loading, and small arms ammunition, reconversion will be easier than for metalworking and metal fabricating industries. Most of the industrial chemicals, paints and varnishes and lacquers, and drugs and medicines have vast alternative peacetime uses and applications.

Developments since 1939 have caused a number of locality shifts in the chemical manufacturing industry. Many of these are the result of the distribution of the new facilities, particularly the inland shifting of the explosives and shell loading industry. In this industry, Indiana assumes importance, as do the South Atlantic region, the East South Central area, and the mountain area (not shown on the table).

Percent of Total United States Production and Rank of States Producing Chemicals and Allied Products, 1939 and 1944

	1939		1944	
	Rank	Percent	Percent	Rank
New Jersey	1	14.0	16.0	1
New York	2	9.0	10.0	2
New England States	3	5.5	5.0	6
Ohio	4	5.5	6.0	4
Indiana	4	5.5	7.4	3
Illinois	5	5.0	6.0	4
Michigan	5	5.0	5.5	5
Pennsylvania	5	5.0	5.0	6
California	6	4.5	3.5	9
Virginia	7	3.3	4.0	8
Maryland	8	2.8	1.5	15
West Virginia	9	2.7	4.2	7
Texas	10	2.5	5.0	6
Missouri	11	2.0	3.0	10
Alabama	11	2.0	2.4	11
Tennessee	12	1.7	2.1	13
Georgia	13	1.5	0.8	17
Ky. and Miss.	14	1.4	1.6	14
The Carolinas	14	1.4	0.8	17
Pa., Del. and D. C.	15	1.3	1.0	16
Ark., La. and Okla.	16	1.1	2.3	12
Kansas	17	1.0	4.0	8
All others	..	17.0	3.0	..
United States, total		100.0	100.0	

Source: Census of 1939. Data for 1944 are estimated on the basis of total labor cost from estimates of payroll and reports of facilities distribution and other sources.

LOCALITY SHIFTS

But in one sense, these products and this industry are not important, since when the peace comes, it may be expected to taper off. It is therefore important to determine those locality shifts which are of more than temporary significance, such as new chemicals, the synthetic rubber program, and others. In the more permanent shifting, the state of Texas emerges as significant, comparing with some of the Middle Atlantic and East North Central States. Virginia and West Virginia also are of importance because they, too, have a substratum of industry which will persist after the war.

Summarizing the situation in somewhat tentative terms, states like Kentucky, New Mexico and Utah and Indiana may emerge with West Virginia and Texas as new or developing chemical states. On the other hand the West North Central States will suffer along with the South Atlantic States some changes relative to their present 1944 position. The decline, or apparent decline, in the Pacific region is apparently not a long run change but a change arising from differences in product and shifting of products, such as the rising plastics developments which have been reported.

In terms of over-all values, the rank of the states for 1939 and 1944 is approximately that shown in the accompanying table. These are, of course, subject to correction, and they are made chiefly for the purpose of showing in a general way the shift of the rank of the chief chemical producing states or areas during the war.

In the table, one or two other changes of significance should be observed. New Jersey still ranks as the chief chemical producing state, while New York comes next. Indiana and Texas have made remarkable advances. On both the Pacific Coast and the New England region, the impact has been for the industry to spread out somewhat, while the mid-continent and South Atlantic regions are dominated very much by the explosives program.

While the effects of wage stabilization upon the chemical industries can not be studied in detail here, one or two important effects should be mentioned briefly. Between 600 and 700 thousands of workers are employed in the chemical industries, the largest number being employed in explosives, and small arms ammunition, and in rayon and allied products, drugs, and industrial chemicals. Presently, there appears to be a serious shortage of personnel, an estimated 50,000 being needed to attain the level set for 1945.

The chemical industries no longer occupy their former preferred position as a high wage industry. Yet the labor required to man the unit operations and processes is of an unusually high type, steady, and schooled in the industrial chemical processes. It is well known that the differentials between the skilled and unskilled are being narrowed by the stabilization policy of the War Labor Board. The increases in earnings for the lower paid groups doubled those of higher paid workers. Meanwhile productivity in the industry remains high, and has, from such evidence as may be obtained, shown an increase.

It has been claimed by experts in the industry, that there are more than 5,000 job classifications. These vary among plants, in the same plants, among industries, and groups of industries, and some are dependent upon the type of secret process or special machine in use. From recent experience, it appears that attempts

to set up some scheme of standard interchangeable job classification systems are an important consideration. One of the chief reasons for this interest has been the inability of the War Labor Board to arrive at a satisfactory scheme of brackets by occupation. In the Middle Atlantic region a number of industry committees have been working on the problem for two years. In view of the need for replacements, particularly among the higher type of skilled worker, the problem is acute. Both new training and recruiting plans are common discussion points.

Unions, which represent about one-quarter of the industry, are themselves giving classification some consideration. Replacements are also a subject of study by the unions, particularly in the eastern sections of the country. There are three affiliated union groups, as well as a very strong independent group of unions. Representatives of all these organizations tend to have a better technical grasp of the industry's problem than may appear to be customary in some unions.

One of the developments which has focused much attention to the subject of classifications of occupations has been the comprehensive survey of the industry in New York and New Jersey which was planned and directed from the office of the Bureau of Labor Statistics in New York City. Both industry and members of the various union groups worked in the closest cooperation with the Bureau, along with industry and labor members of the War Labor Board itself. An accepted scale or range of skill of groups was tentatively adopted in order that the survey information might have the maximum usefulness. The industry gave detailed wage information to the Bureau, and when the data were finally available, the demand from the industry was tremendous. It has been generally agreed that this study marks a step forward towards industry job classifications.

There yet remains a number of what have been termed by industry people as "fringe questions." Among these are vacations with pay, promotion policies, and the place of incentive earnings as a method of wage payment. In general, the industry has been traditionally liberal regarding vacation practices, and leave. Nonetheless, there is no special uniformity of practice. Promotion policies have remained obscured by virtue of the extensive background and training required before a highly skilled man emerges. Again, these practices have remained peculiar to each establishment, and dependent upon its own particular requirements.

Chemical workers do not move from plant to plant. In fact they tend to remain in the same establishment and master the processes of that plant. Certain aspects of their training tend to be narrower than otherwise, although this is not necessarily a defect. A stable labor force may offset many of customary difficulties experienced in other industries. Additional training programs are indicated, however, and in aiming to train its higher skilled workers, the industry must adopt a broadened training program.

The problem of incentive earnings presents unusual aspects. Speed is not a requisite of chemical production in the same sense it may be in a mass-production metal plant. Attention to detail and sustained attention are necessarily of prime importance. Incentives might therefore take the form of special bonus arrangements, group or individual or merit. Finally, the margin between the earnings of maintenance workers and the higher skilled processing operators is not clear. Maintenance men as a group appear to receive relatively higher earnings. Processing workers show a range of earnings, and these are not always in the same relation to their skill as maintenance workers. The relation has not been clearly evaluated or analyzed and needs clarification.

Lack of seasonality in many branches of the industry has always been an attraction to employment in the industry. With the intense and sustained war production period since 1939, this factor has been offset by higher earnings on an annual basis in many other industries. Yet, from the standpoint of annual earnings, the very lack of seasonality is an inducement for the industry to consider annual earnings as a means of wage payment.

With brighter prospects than many rival industries, with its future employment possibilities increasing, even in the face of its present wage position and manpower problems, the chemical industry offers an interesting future in its permanent place as one of the vital and important industries in the American industrial picture.

Outlook for Rubber in 1945

Crude rubber once again becomes the most critical of all strategic materials, reports J. F. Clark, director of the Rubber Bureau of WPB. Present production schedules in 1945 will consume approximately 144,000 tons of crude rubber resulting in a net stockpile loss for the current year of approximately 35,000 tons. Inasmuch as the United States stockpile position as of Jan. 1, 1945, was 96,000 tons, it will decline to 61,000 next January 1.

There is insufficient GR-I (butyl) to meet over-all tube requirements, however, indications are that there will be an adequate supply to meet airplant and truck tube requirements. Production of GR-S (buna S) in 1944 was 668,834 tons. The current year's requirements are said to be 881,000 tons. The increased requirements in the last half of 1945 and 1946 are substantially beyond the present capacities of the copolymer and raw materials plants, and additions to the plants will be necessary amounting in cost to about 3 percent ($22,000,000) of the presently estimated investment in government-owned synthetic rubber plants of $725,000,000. The rated capacity of the government GR-S plants is 705,000 long tons, and the plants have demonstrated actual capacity of 860,000. The requirement for next year of 1,054,000 long tons is 22.5 percent over the present demonstrated capacity and 49.5 percent over the rated capacity. With comparatively small additions an output up to nearly 50 percent over their rated capacity can be counted on for 1946 if needed.

The most serious problems which the industry will face in its efforts to achieve 1945 and 1946 production goals are in the fields of manpower and component materials required for the production of rubber products, according to Clark. The potential of rayon tire cord for 1945 is estimated at 245,000,000 lb. and for 1946 at 296,000,000 lb. The requirements for high tenacity rayon tire cord are very much higher.

Requirements of carbon black are greatly in excess of anything envisioned heretofore due, first, to the use of synthetic versus crude rubber, and second, to the greatly expanded size of the tire industry. Whereas channel and furnace blacks can be used somewhat interchangeably, present technological knowledge shows a depreciation in quality in some specific applications, if blacks of the furnace type have to be used to substitute for those of the channel type.

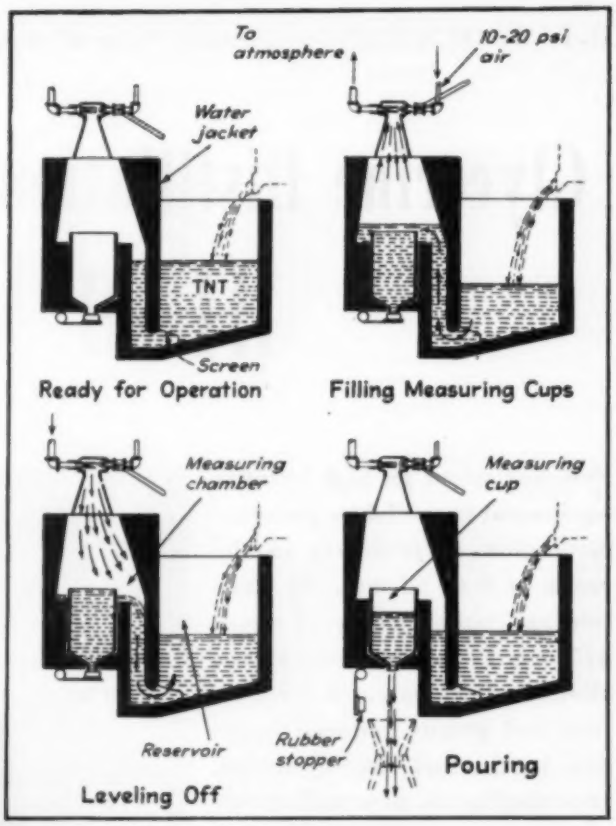
Facilities for channel black authorized in 1944 are now in process of completion. Value of the projects approved last year is more than $21,000,000. Additional facilities have been approved since the first of the year and steps have been taken to increase production at plants already in operation. The Chemical Bureau reports that a steady increase in production will continue throughout 1945.

Some consideration is being given to the Schock process of cracking natural gas to produce carbon black and acetylene. While no decision has been reached at the time this is being written, it is thought that the time element precludes the possibility of the construction for production by that process.

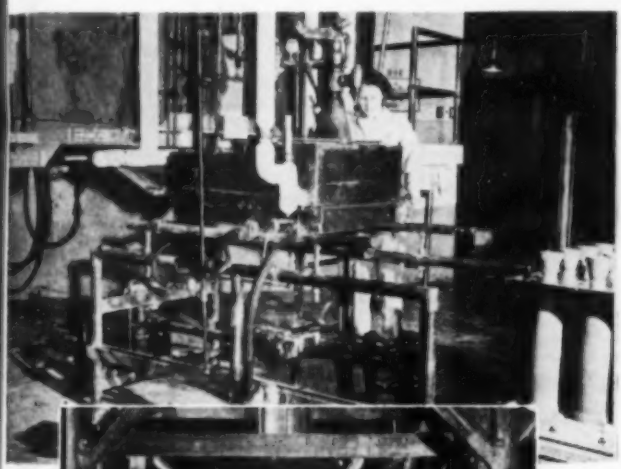
The demand for reclaim rubber has increased substantially as a result of the shortage of carbon blacks. Whereas approximately 16,000 tons per month have been adequate to meet recent demand, the industry must now increase its production to 25,000 tons or only 1,000 tons less than the maximum ever attained.

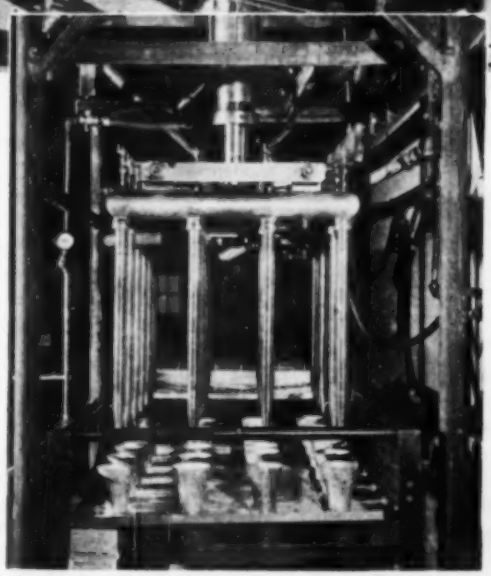
ARMY DEVELOPS MECHANICAL SHELL LOADING

Filling high explosive shells with TNT has remained until recently a manual operation. Through ingenuity of army personnel at the Illinois Ordnance Plant, individual bucket pouring of melted TNT is being supplanted by a mechanical device which increases production, saves labor, and improves efficiency. This device might be adapted to similar operations.



Above—Volumetric pouring machine; simple operation of lever evacuates chamber to fill measuring cup, reversing lever permits excess TNT to flow back to reservoir; quick opening stopper allows measured amount to fill shell

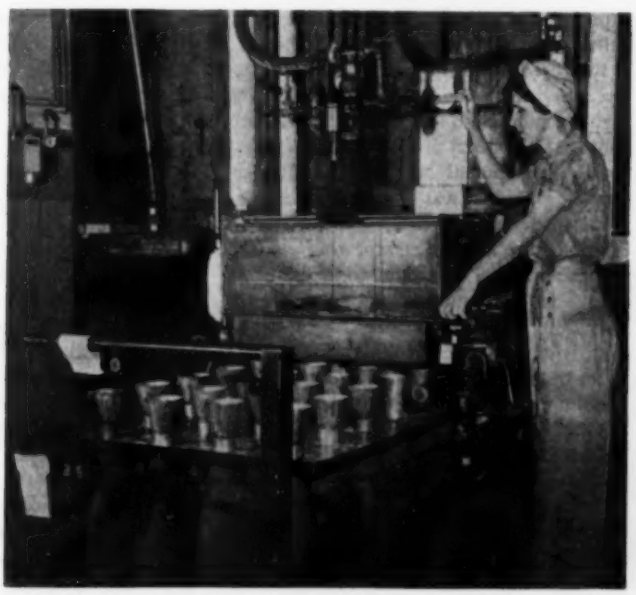




Left—Mechanical filler showing equipment arrangement; note indexing device at lower left which fastens to truck and spots empty shells in exactly the right position; at upper left is tempering tank for holding supply of melted TNT at the required temperature and consistency for pouring

Multiple coring machine developed at Kansas Ordnance Plant, consists of heated non-sparking bayonets to remelt centers of filled shells eliminating pockets caused by shrinkage during cooling

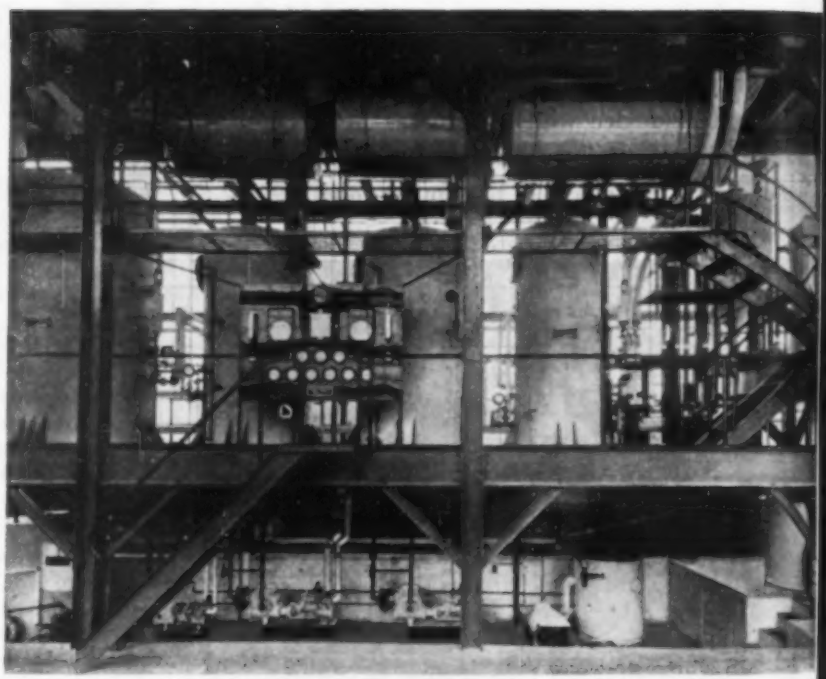
Below—Load of shells being filled eight at a time



G.J. STOCKMAN *Vice-President, Wurster & Sanger, Inc., Chicago, Ill.*

Glycerine Distillation Greatly Improved by HIGH VACUUM

Now that steam jet high vacuum equipment is available, glycerine distillation at pressures in the range of 6 to 12 mm. Hg absolute and temperatures of about 315 deg. F. has increased yields, eliminated sweet-water production and greatly reduced losses due to thermal decomposition. One distillation now suffices for the production of all grades of glycerine including commercial and high gravity.—*Editors*



Wurster & Sanger continuous glycerine distillation plant showing stills, concentrator and deodorizer below, condensers above; note control instruments

GLYCERINE recovery in distillation has been improved with every major improvement in the operation of vacuum equipment. Modern steam jet vacuum equipment makes it possible to operate at 6 to 12 mm. Hg absolute, with the result that glycerol yields on distillation have increased to over 98.5 percent. Glycerine produced in one distillation by present methods is ready for use, no sweet-water is produced, and operating costs have been cut in half as a consequence.

Improved results in the distillation of glycerine are obtained by operation at high vacuum and low temperature, with continuous removal of salt. Before practical vacuum equipment was available to industry, glycerine was distilled at atmospheric pressure, and losses due to decomposition were high. Reciprocating vacuum pumps made it possible to operate at 2 to 3 in. Hg absolute, with consequent reduction of decomposition losses. However, large quantities of dilute distillate, or sweet-water, were produced, requiring rehandling and redistilling.

Glycerine is one of the few industrial chemicals available in large quantities, and in almost pure form. As a war chemical in particular, glycerine is required in many medicinals as a solvent or lubricant. It is an ingredient of sulfa drug ointments, and of explosives such as dynamite, nitroglycerine and gunpowder of various types which use glycerine as the base material. War industries also need large quantities of glycerine for the manufacture of synthetic resins designed for protective coatings, plastics and binders.

FLASH DISTILLATION

Modern stills are designed for flash distillation of the glycerine, and supply the required heat without heating the liquor appreciably above the temperature required for vaporization. The crude glycerine is fed continuously to the still by means of an automatic liquid level controller, which maintains a constant level. As distillation proceeds, salt settles out in a drum underneath the still.

Constant removal of salt and accumulated impurities makes it possible to run the distilling unit continuously, and to maintain uniformly consistent operating conditions in both still and condenser. The modern still, operating at a vacuum of 6 to 12 mm. absolute pressure and a steam pressure not exceeding 100 lb. per sq. in. in the heating coils, permits distillation with a liquid temperature of 315 to 320 deg. F. At this low temperature there is a minimum of decomposition of glycerine, with resultant high yields.

High vacuum on the still greatly reduces the amount of injected or blowing steam required. About 0.25 lb. of blowing steam per pound of glycerine is now used. Old types of stills operating at lower vacuum required as much as 2 lb. of injected steam per pound of glycerine distilled. Since all of the distilled glycerine is condensed in highly concentrated form, little steam is now used for concentrating purposes. There is, therefore, a considerable saving in total steam used.

With modern steam jet vacuum equipment, the over-all steam consumption, in-

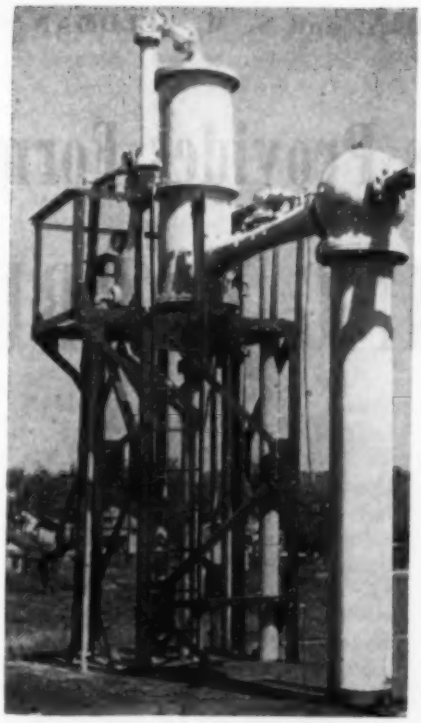
cluding that used for injection, for heating coils in the stills, for operating the vacuum equipment, for finishing the distilled glycerine and for operating discharge pumps, is from 2½ to 3½ lb. per pound of glycerine distilled, depending upon the size of the plant.

Steam and glycerine vapors leaving the still are passed through a separator to remove entrainment. The glycerine vapors are then condensed in a series of three surface condensers while the steam passes on to a three-stage steam jet air ejector. The first surface condenser or preheater uses the feed to the still as the condensing medium, thus preheating the crude glycerine. This preheater and the second surface condenser, or cooler, are maintained at a temperature which will condense most of the glycerine vapor but very little water vapor. The glycerine from these first two condensers is collected in the deodorizer, and is of a gravity required for commercial grades of distilled glycerine without further concentration.

DYNAMITE GRADE

The third and final surface condenser is run at a lower temperature and condenses the remaining traces of glycerine in the vapors together with some water. This small fraction, containing over 90 percent glycerol, is run to the concentrator where it is condensed to high gravity or dynamite glycerine. The temperatures of the condensers are automatically controlled.

Condensate is temporarily held in the receivers underneath the condensers while finishing and discharging the glycerine in the deodorizer and concentrator. Finished glycerine is pumped from the deodorizer and concentrator under vacuum, so that the vacuum on the unit and the continuity of operation are not disturbed. A three-stage steam jet ejector of sufficient capacity to maintain the high vacuum serves the entire distilling plant.



Elliott three-stage steam jet vacuum producer installed on plant roof above a glycerine plant; flow sheet identifies various parts

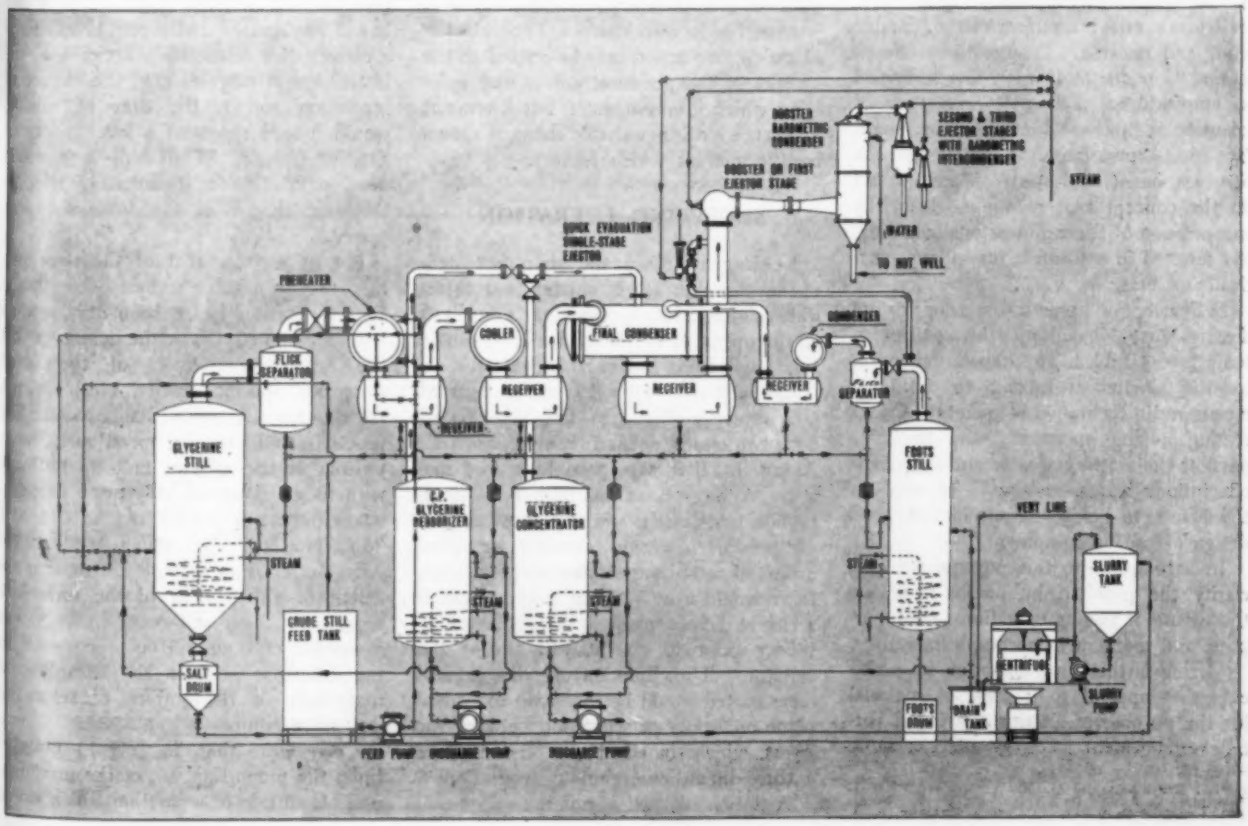
LOSSES REDUCED

The diminished destructive action of high vacuum and low temperature and their consequent beneficial affect on the glycerine is shown by the appearance of the foots. The foots produced is dark yellow in color and the salt crystals show clearly, whereas by former methods of distillation at higher temperature the foots was a black amorphous mass.

As the quantity of foots is greatly reduced, the total glycerol loss is relatively small. Glycerol content of the foots is about 14 percent, so that loss in the foots is approximately 1 per cent of the glycerol in the crude. It is therefore not necessary to resort to the former costly and troublesome operation for recovery.

By use of modern vacuum equipment total yields of 97 to 98 per cent of the glycerol in the crude are obtained in one distillation, in the form of salable products. In addition, C. P., as well as dynamite and high gravity grades of glycerine, are now obtained in one distillation.

Flow sheet of Wurster & Sanger continuous glycerine plant for producing commercial and refined grades



A. BROTHMAN, G. N. WOLLAN, and S. M. FELDMAN *

New Analysis Provides Formula to Solve MIXING PROBLEMS

Application of analytical methods has brought forth a new relationship between mixing time and mixing completion. Based on the theory of probability and resulting from a study of mixing kinetics, the derived expression and its implications may well lead the way to closer and more reliable correlation of mechanical design and functional performance of mixers.—*Editors*

UNIVERSALLY used by the process industries, mixing operations have been, for several years, the subject of considerable study and research. Despite these efforts, mixing, for the most part, has remained an empirical art with little foundation of scientific analysis as found in other important unit operations. A new approach however, based on a study of kinetics and on the concept that mixing is essentially an operation of three dimensional shuffling, has resulted in a formula for solving practical problems.

In developing a practical method for analyzing mixer operations this article attempts to establish an over-all expression for the kinetics of mixing, to outline a means and a technique of quantatively analyzing mixing operations, and to make possible the drawing of wide and significant conclusions which may well be used in the future to guide the specification and design of mixing equipment.

In accomplishing this purpose we may clarify the problem by briefly reviewing the nature of mixing operations, their purpose, and methods of accomplishment.

Mixing is that unit operation in which energy is applied to a mass of material for the purpose of altering the initial particle arrangement so as to effect a more desirable particle arrangement. While the object of this treatment is usually to blend two or more materials into a more homogenous mixture, it may also serve to promote accompanying reactions, or it may support other unit operations such as heat transfer. Various means of energy input to produce mixing may include: (1) The inducting of natural convection (by heating or cooling); (2) the transmission of high frequency vibrations through the material (as in the passage of super-sonic wave through liquids); (3) the inducting of turbulence as a result of friction in fluid flow in pipes and orifices; (4) the translation of the energy imparted to a moving member (as in the case of conventional mixing equipment).

It is important to note, however, that regardless of its end purpose or the methods of application of energy, mixing is possessed of its own kinetics. The kinetics of the mixing action may be related to the kinetics of the phenomenon or unit operation which it accompanies, but it remains in essence a distinguishable entity as shown by the analysis which follows.

SHUFFLING OPERATION

Keeping in mind the simplified definition that the act of mixing is a three-dimensional shuffling operation, an analysis of the operation of the device as shown in Fig. 1 will bring forth certain relations.

Consider the propeller mixer agitated tank shown in Fig. 1 to have been loaded with two clearly defined layers of materials *A* and *B*. If it were possible to load material *A* on top of material *B* in such fashion that layer *B* was not disturbed and all possible diffusion currents or other means of inter-layer seepage were arrested, there would exist between layers *A* and *B* a clearly defined plane of separation or interface prior to the starting up of the agitator. The function of the agitator once started would be to extend the initial plane or surface of separation between the layers, which, in effect can be considered a three-dimensional shuffling operation.

Agitation of itself is not the sole means acting to extend this interface since molecular diffusion occurs to some extent in all cases. However, the effect of the agitator is to provide optimum conditions or environments for promotion of diffusion, so for practical purposes, the action of the mixer may be considered as the overwhelming factor in effecting a growth of the surface of separation.

If we assume that the agitator assembly is designed to engage the tank mass uniformly so that the mass will follow the general path indicated by the arrows, then the direct mechanical action exerted by the propeller as it induces the turnover of the tank contents, and the attending condition of turbulence, will extend the surface of separation. While we know this to be qualitatively true, regardless of time, it is also obvious that this extension of the interface between components *A* and *B* will vary quantitatively with time. Such a quantitative relationship between *S*, the instantaneous magnitude of the surface of separation and *t*, the time of mixing, would indeed represent a kinetics expression for mixing. The steps involved in developing such a quantitative relationship are shown in the following paragraphs.

Let us suppose that of the maximum theoretically possible surface of separation S_p a proportion y_t has been developed in t units of time. Given the condition that the fluid characteristics of the blend (viscosity, specific gravity, etc.) do not undergo any substantial change as blending proceeds; and that the operational characteristics of the agitator unit do not vary with time. Then we may quite properly, by employing a variant of the statistical "diffusion law" (of which the Law of Mass Action is an example), state that the extent of enlargement of the surface of separation which will occur in any given increment of time will be proportional to the difference between the instantaneous magnitude of the surface of separation and its maximum possible value. Thus, we may write that, in $(t+1)$ units of time, the proportion y_{t+1} of the maximum possible surface of separation which would

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be generated is given by the following:

$$y_{t+1} = y_t + \phi(1 - y_t) \quad (1)$$

where ϕ is the constant of proportionality mentioned above. Now, if we set

$$Z_t = 1 - y_t \quad (2)$$

it follows then that we may write Equation (1) as:

$$1 - Z_{t+1} = 1 - Z_t + \phi Z_t \quad (3)$$

which upon simplification becomes:

$$Z_{t+1} = Z_t(1 - \phi) \quad (4)$$

From the relationship between the successive series members, Z_t and Z_{t-1}, it follows that any number of the series Z_0, Z_1, ... Z_t, Z_{t-1}, ...would be generated according to:

$$Z_t = Z_0(1 - \phi)^t \quad (5)$$

But, according to Equation (2),

$$Z_0 = 1 - y_0 \quad (6)$$

For the overwhelming majority of mixing problems, it may well be said that y_0, the proportion of the maximum value of S exposed prior to mixing, would take on negligible dimensions compared to the magnitude which S would assume where dispersion to molecular, ionic, or fine macroscopic levels is involved. Hence, for such instances, we may say that:

$$Z_0 \cong 1 \quad (7)$$

whereby we may re write Equation (5) as:

$$Z_t = (1 - \phi)^t$$

or, by Equation (2):

$$1 - y_t = (1 - \phi)^t = e^{t \log (1-\phi)} \quad (8)$$

Then if

$$c = \log \frac{1}{1 - \phi} \quad (9)$$

we arrive finally at:

$$y_t = 1 - e^{-ct} \quad (10)$$

which is to state that the proportion of the maximum theoretical surface of separation which would be exposed after a time of mixing t would be given by $(1 - e^{-ct})$ where c is a constant dependent upon the individual mixing problem at hand. Hence, the instantaneous value of S would be given by:

$$S = S_p(1 - e^{-ct}) \quad (11)$$

While Equation (11) represents a legitimately arrived at kinetic expression for mixing phenomenon, it is quite obvious that in itself it has little value since S is virtually incapable of experimental evaluation. Further steps, therefore, must be taken in our attack on the problem to make this equation useful from a practical point of view.

To evaluate mixing in terms of some factor or characteristic which will permit a practical and simple experimental determination it is obvious that, since we have defined mixing as a three-dimensional shuffling operation, the most direct evaluation of a mixing phenomenon lies in terms of the completeness of the dispersion of the constituents throughout the batch volume. In other words, we should be able to evaluate the completion of mixing by identifying the permeation or distribution of elements of the surface of separation throughout the mass of material.

ANOTHER APPROACH

Reducing this problem then, to its simplest terms, we arrive at the statement: If the volume of the batch were divided into a large number of units of equal volume (see Fig. 2), a determination of the condition of mixture existing could be made in terms of the uniformity of dispersion of the elements of the generated surface of separation among these units.

A practical and usable quantitative relationship between the dispersion of elements and the time of mixing can be brought out if we do not attempt to distinguish between units of the batch which contain one element of the generated surface of separation and those which contain more than one element. For the sake of ultimately arriving at an expression which will have utility, it is possible to consider distribution to any unit of volume to have been attained if at least one element of the surface of separation is present in that volume unit. With this limitation in mind, a more practical approach to a solution of this problem may be made.

In Fig. 2 we have divided the batch volume as shown in Fig. 1 into a large number of equal sized imaginary cubes. As illustrated in Fig. 3 we can consider the interface, S, to be composed of n elements such as ΔS. Consider n to be a very large, but fixed number—a number approaching infinity as a limit so that all such units as ΔS become equal in magnitude. As the surface of separation is developed, the magnitude of ΔS $\left(\Delta S = \frac{S}{n}\right)$ would increase. The probability, U_i, that some part of a given element of the surface, say ΔS_i, would be found in a randomly chosen cube is proportional to the magnitude of ΔS_i and $U_i = k\Delta S_i$ where k is the constant of proportionality.

Since, for the above conditions imposed on n, all of the elements of the suirface of separation are equal, and the cube ΔV is randomly chosen, this relation holds for all of the elements of the surface of separation, and we can write:

$$U_i = k\Delta S, \quad (12)$$

where i may vary from 1 to n.

The probability that at least one element of the given surface of separation will enter the cube ΔV may be ascertained by using the "At least one theorem" of de Montmort, a step omitted here. Applying this theorem to a system in which n events

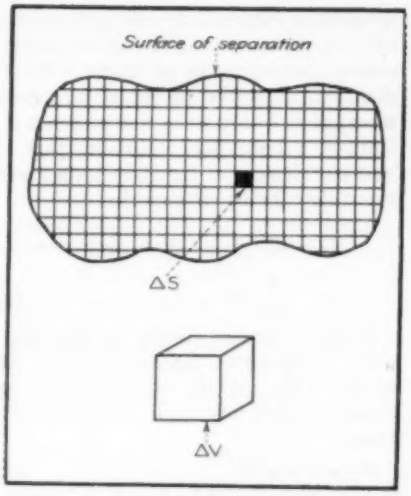
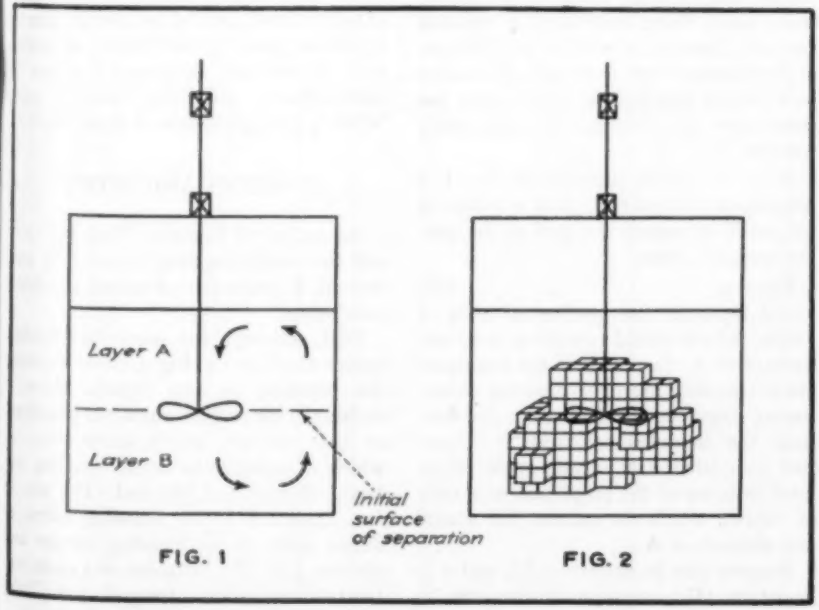


Fig. 3—Cross section showing elements of the interface

Fig. 1—Simple mixer showing circulation pattern of mixture

Fig. 2—The mix broken down into a large number of equal sized cubes



are possible (where P_n represents the probability of at least one of the n events happening, and where the probabilities for all elements ΔS of the surface of separation are equal to $k\Delta S$), when n approaches infinity as a limit, the probability that at least one element of the given surface will enter the cube ΔV is given by:

$$P_n = kS - \frac{1}{2!}k^2S^2 + \frac{1}{3!}k^3S^3 - \frac{1}{4!}k^4S^4 + \ldots . \quad (13)$$

However, it will readily be seen that, where n approaches infinity as a limit, all of the terms on the righthand side of Equation (13) will sum to $(1 - e^{-kS})$. Hence:

$$P_n = 1 - e^{-kS} \quad (14)$$

But by Equation (11) $S = S_p(1 - e^{-ct})$. Hence

$$P_n = 1 - e^{-kS_p(1-e^{-ct})} \quad (15)$$

Equation (15) then, represents the probability that at least one element of the surface of separation generated by the mixing action will enter a randomly chosen portion of the batch volume after a time t of the mixer's operation. The significance of this expression, however, is wider than this statement of its immediate meaning.

LOGICAL DEDUCTIONS

The broad significance of Equation (15) is brought out by further deduction. Since we have assumed that the mixer developed a uniform engagement of the mix material, and that the units of volume, or cubes, comprising the total volume are all equal in dimensions, it is reasonable to believe that the probability that any one randomly chosen cube will contain an element of mixture is also the probability that any other cube composing the total batch volume will also contain an element of mixture. Where this is true, for any given number of cubes totalling to the total batch volume, the concept of P_n as defined above, becomes interchangeable with P_t which represents the proportion of the total number of cubes containing at least one element of the surface of separation. This brings forth a wider and more inclusive statement concerning the dispersion in space of the elements of the surface of separation. Where P_t represents the proportion of equal sizes subdivisions of the mixed volume which will contain mixture after an elapsed mixing time t, the relation between P_t and t will be given by:

$$P_t = 1 - e^{-kS_p(1-e^{-ct})} \quad (16)$$

It may well be argued that the presence of one element of mixture within a unit subdivision of the batch volume can hardly define a level of mixture adequate to entitle it to equal consideration with another unit subdivision which contains more than one element of mixture. However, it was necessary to assume this basis in order to derive Equation (16), the apparent inadequacy of which may be readily overcome.

Let us suppose that in applying Equation (16) to the device shown in Fig. 1, a number of samples sufficient to evaluate P_t have been taken after a certain mixing time, and that this process has been repeated at a later stage of the mixing operation, so that we have been able to determine in Equation (16) the values of c and kS_p for the given case. The fact that the samples withdrawn at the first sampling might indicate various levels of mixture merely serves to emphasize that the purpose of continuing the process of mixing is to narrow down the standard mean deviation from the formulational ratio between components A and B. Thus, in the widest possible sense, the operation of mixing not only serves to widen by shuffling the permeation of the batch volume, by elements of the interface, but it also serves to narrow down continuously the deviations in composition from the formulation ratio of various samples that might be withdrawn. This thought justifies the further conclusion that after any given elapsed mixing time, while there may exist a *practical* level of dispersion or mixture, nevertheless, in the *absolute sense* there will at all times be a varying composition ratio among the component subdivisions of the batch volume.

If, in the system described in Fig. 1, a permeation of x units of A in a system of volume V represents the goal of the mixing operation, then

$$V/x = v \quad (17)$$

would represent the number of units of volume which should contain at least one element of A. In line with the comments above regarding mixing as a means of narrowing down the standard mean deviation from the formulational ratio, it follows that completeness of mixing could be defined in terms of the proportion of v units of volume which do contain the alloted one element of A.

Suppose that in evaluating kS_p and c in Equation (16), samples of the size V_s were taken. By Equation (15)—Equation (16) in different form—the probability that any randomly chosen unit of volume V_s would not contain at least one element of mixture would be given by $[e^{-kS_p(1-e^{-ct})}]$. By this logic, the probability that the sample v (or the proportion of such units of volume, referred to above), which would not contain at least one element of mixture, would be given by:

$$[e^{-kS_p}\,[e^{-kS_p(1-e^{-ct})}]_{s}]^{v/V} \quad (18)$$

Hence, we may say that:

$$(P_t)_s = 1 - [e^{-kS_p\,(1-e^{-ct})}]^{v/V} \quad (19)$$

where $(P_t)_s$ describes a satisfactory end point for the mixing operation in terms of the number of v units which contain the one element of A which they should contain according to Equation (17).

Thus, where $(P_t)_s$ is so set as to describe a satisfactory level of mixture, solving for t in Equation (19), where the values of kS_p and c have previously been determined for samples of size V_s, will yield the required time of mixing to achieve the desired level of mixture.

We have thus arrived at our prime goals (1) We have derived an overall kinetic expression covering the kinetics of mixing and (2) we have developed a means for quantitatively predicting mixing time. What is the significance of these results?

ANALYSIS AND SCOPE

An analysis of Equation (16) and (19) and the conditions upon which they were derived, is productive of several significant conclusions.

First, although the particular blending system considered in Fig. 1 is one involving the blending of two liquids, there is nothing in the picture which was generated or the concepts which came from it which is exclusive to liquid blending systems. Equations (16) and (19) are, in fact, applicable to any blending system or device since, in all blending devices and systems, (1) The extension of a given surface/s of separation is the goal; and (2) be

Explanation of Symbols Used

A	Component A
B	Component B
c	Log $1/1 - \phi$, a unit depending on ϕ, hence on the problem at hand
e	Base of natural log system
k	Constant of proportionality between U_i and ΔS_i
m	Number of components in system
n	number of elements of surface; $n\Delta S = S$ when $n \to \infty$
P	Probability of some part of at least one element of surface entering a random element of volume
P_t	Proportion of equal sized volume units containing mixture after time t
$(P_t)_s$	Satisfactory mixing end point
S	Instantaneous magnitude of interface
S_p	Maximum possible surface of separation
ΔS	An element of surface of separation
t	Time of mixing
U_i	Probability that some part of ΔS_i will enter ΔV
V	Volume of system
v	Number of units of volume containing at least one element of A
V_s	Volume of a sample
ΔV	A randomly chosen cube
x	Number of units of A which permeate volume V
y_t	S/S_p developed in time t
Z	$1 - y_t$
ϕ	A constant of proportionality in the development of the interface

necessity, the replacement of the zones of unblended material with blended material involves the migration of elements of the surface/s of separation to the unit components of the batch volume.

Then again, it is significant to note that this analysis applies specifically to a binary system, i.e., a two-constituent system. It follows quite readily however, that where m components are involved, the extension and dispersion of $(m-1)$ surfaces of separation is involved. Equation (16), in a system involving m components, would be applied to each of the $(m-1)$ surfaces of separation, and the constants kS_p and c would be determined for each of the surfaces of separation. Thus where, for a system of three components $k'S'_p$, $k''S''_p$, c' and c'' represent the constants for the two surfaces of separation involved, Equation (19) would take the form:

$$(P_t)'_s][(P_t)''_s] = [1 - (e^{-k'S'_p(1-e^{-tc'})v'/Vo})] \times [1 - (e^{-k''S''(1-e^{-tc''})v''/Vo})] \quad (20)$$

where the presence of at least one element of each of the two surfaces of separation in $(P_t)'_s$ and $(P_t)''_s$ proportions of v' and v'' units of volume respectively corresponded to a satisfactory level of mixture, and v' and v'' are defined in accordance with Equation (17). Although Equation (20) sets the model for the most theoretically correct handling of systems of two or more components, it would suffice in practice to treat such systems in terms of the migration and permeation of "the most difficultly distributed component" by itself.

The third conclusion to be drawn from a study of the results and methods of derivation used above is of far-reaching importance as far as the design and specification of mixing equipment is concerned. It is quite obvious that, in any given blending problem, the values of c and kS_p in Equation (16) would be defined by: (1) The viscosity, specific gravity, ultimate dimensions and diffusivity characteristics of the components of any liquid system; (2) the specific gravity, surface properties, and particle sizes of the components in any solid-blending system; and (3) the condition of batch-turnover and turbulence set up by the mixer device proper.

Thus, it is entirely scientific to say, in comparing any two mixing problems, that if the properties of the "mix" components were reasonably close, the same device could be expected to give roughly identical performance with respect to the time required to achieve mixing, providing the same degree of permeation of the batch by any given component is required. Especially does this statement seem true in view of the fact that in the relationship between P_t and t in Equation (16) the factor t appears in the upper position of a double exponential. These conclusions place the stamp of adequacy upon those methods of mixer design and specification which proceed from the logic of anology.

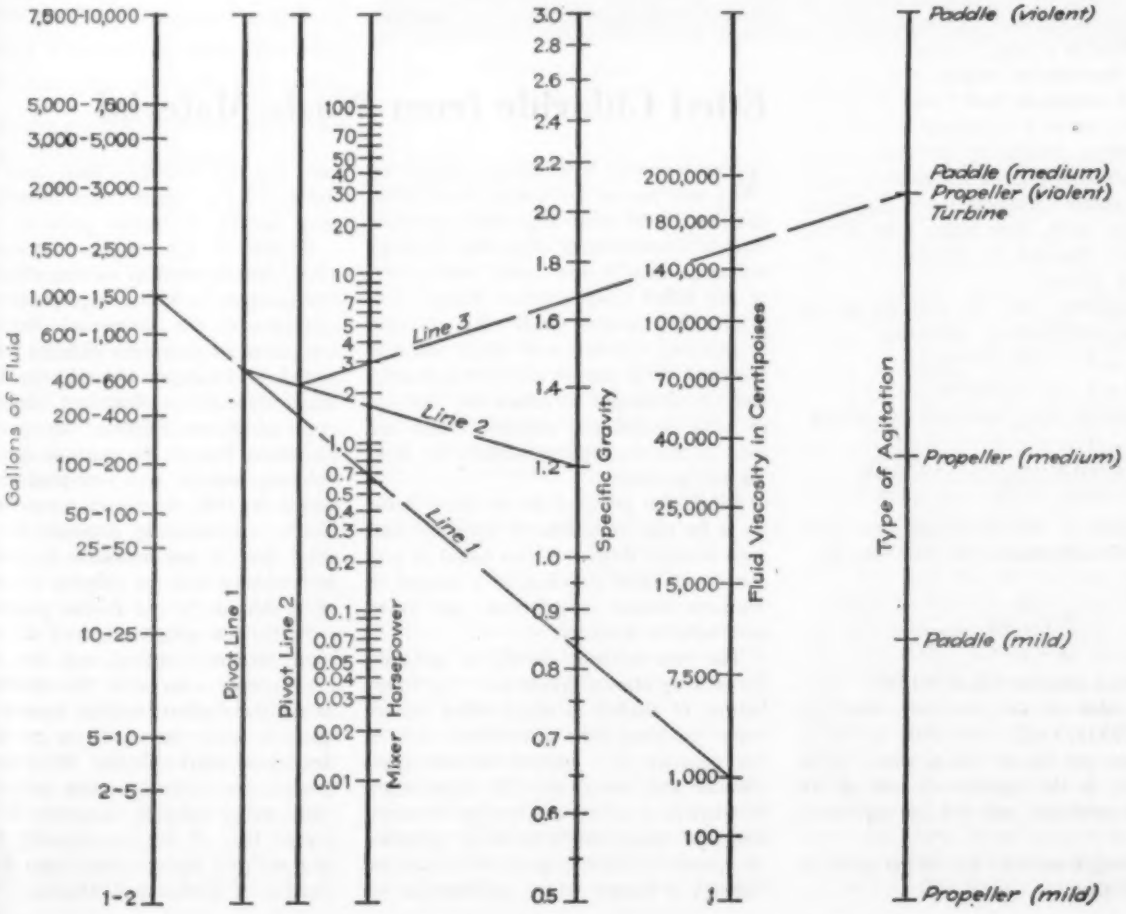
Anology methods of mixer design are illustrated in a loose way by the employment for mixer specifications of such data as are shown in the nomograph which gives for various sizes of mixing kettle and consistency of liquid, that rate of work input, by propeller or slow speed mixer which has been found, in practice, to establish satisfactory conditions of mixing.

TURBULENCE CONSTANT?

The fourth conclusion to be drawn from the derivation of Equation (19) is also of great importance. We remarked above that the values of c and kS_p in Equation (19) would be determined by the "fluid" properties of the mass being blended, and the condition of turbulence or batch turnover exerted by the mixing device.

It is obvious that the fluid properties of the mix would remain constant, for all practical purposes, regardless of the scale on which the operations were carried out. Except in special cases, such as where

Nomograph for approximating power requirements of mixers



thixotropic substances are encountered, the fluid properties of the mass would remain constant, regardless of the type of mixing device used. Excluding special circumstances then, it is logical to expect that if it were possible to set up turbulence criteria such as the Reynolds Number in fluid flow for various types of mixers, criteria which would take into account the placing of the mixer element, the rate of turnover effected by the mixer, and the shape of the kettle used. Equation (19) could be used then, to predict the mixing performance where transfers from one type of mixed to another type of mixer, or transfers from small scale equipment to large scale equipment were involved. This concept, the development of a relationship between the value of c and kS_p in Equation (19) and a turbulence criterion, will form the basis of our extended efforts in this direction.

BLENDING

Consider a conical tumbler blender in which it is proposed to blend 5 cu.ft. of carbon black with 3 cu.ft. of calcium carbonate. A fair sampling of the contents at the end of ten spins of the mixer device indicates that where one cubic inch samples are withdrawn, 0.2 of the samples contain a minimum of 1 mg. of calcium carbonate. Samples of identical size withdrawn at the end of twenty spins of the mixer device indicate 0.865 of the samples contain at last 1 mg. of calcium carbonate. A satisfactory level of mixing exists when 95 percent of the units of volume v comprising the batch contain at least 1 mg. of calcium carbonate, where v is defined as the total batch volume divided by the total number of milligrams of calcium carbonate present. If the calcium carbonate has a density of 20 lb. per cu.ft., how many spins of the mixer are required to achieve this condition of mixing?

By Equation (16), we may set up the following simultaneous equations:

$$0.2 = 1 - e^{-kS_p(1-e^{-10c})}$$
$$0.865 = 1 - e^{-kS_p(1-e^{-20c})}$$

Transforming these equations, we obtain

$$\ln \frac{1}{1-0.2} \Big/ \frac{1}{1-e^{-10c}} = kS_p = \ln \frac{1}{1-0.865} \Big/ \frac{1}{1-e^{-20c}}$$

from which it will be found that: $c = -0.2075$. Substitution of this value in

$$\ln \frac{1}{1-0.2} \Big/ \frac{1}{1-e^{-10c}} - kS_p$$

will yield a value for kS_p of 0.1245.

The value of v for this case, would be $(8)(1{,}728)/(3)(20)(454{,}000) = 0.000{,}508$ cu.in. per mg. of $CaCo_3$ where 20 lb. per cu.ft. is the apparent density of the calcium carbonate, and 454,000 mg. equals 1 lb.

Applying Equation (18) to our problem, we find that:

$$0.95 = 1 - [e^{0.1245\,(1-e^{0.2075t})}]^{\frac{0.000508}{1}}$$

by which t, the number of spins required to achieve the desired level of mixture, would be 52.

LIQUID-MIXING

In the production of fine organic chemicals, it is frequently necessary to wash organic oil layers with a water-salt solution to remove various water soluble impurities, the salt being present as a "salting out" agent to prevent loss of organic products. Let us assume that there are 500 gal. of organic oil to be washed with 35 gal. of a salt solution containing 20 lb. of sodium chloride. An adequate method of testing for dispersion of the water layer would be to test for the presence of chloride ion in samplings of the mix. Using the Mohr titration method, we can conveniently "spot" 10 mg. or more of sodium chloride. Assume that at the end of one minute of mixing, an adequate number of 25 cc. samples of the mix are withdrawn, extracted and titrated. It is found that 0.2 of these samples contain at least 10 mg. of sodium chloride. At the end of five minutes of mixing, 0.75 of the samples are found to contain the 10 mg. of sodium chloride. If a satisfactory level of final dispersion were to be represented by the presence of at least 10 mg. of sodium chloride in 0.9 of v units of volume, where v is designed as the total volume of the mix, divided by the number of 10 mg. portions of sodium chloride comprising the charge, how long a period of mixing would it take to reach this desired state of dispersion?

$$P_t = 1 - e^{-kS_p(1-e^{-t})}$$
$$0.2 = 1 - e^{-kS_p(1-e^{-1c})}$$
$$0.75 = 1 - e^{-kS_p(1-e^{-5c})}$$

Now, $\ln [1/(1-0.2)]/[1-e^{-1c}] = kS_p = \ln [1/(1-0.75)]/[1-e^{-5c}]$, so that $(1-e^{-5c})/(1-e^{-c}) = \ln 4/\ln 1.25 = 2.3 \log 4/2.3 \log 1.25 = 6.22$. Then $1-e^{-c} = 6.22 - 6.22\ e^{-c}$. Letting $y = e^{-c}$ and rearranging, $y^5 - 6.22\ y + 5.22 = 0$, or $y^5 - y - 5.22\ y + 5.22 = 0$. Factoring $y(y-1)(y^3+y^2+y+1) - 5.22\ (y-1) = 0$. Dropping the factor $(y-1)$, since $e^{-c} = 1$ is a useless answer, we have $y^4 + y^3 + y + y + 5.22 = 0$ which obviously has a root between 1 and 2. By Horner's Method (H. A. Bolz, *Prod. Eng.*, April 1943; W. A. Douglas, *Prod. Eng.*, July 1943), the root is $y = 1.109$, correct to three decimal places. Thus, $e^{-c} = 1.109$ and $kS_p = \ln 1.25/(1-e^{-c}) = 2.3 \times 0.0969 \div -0.109 = -2.045$. Now $v = 535$ gal. $\times$ 3,785 cc. per gal. $\div$ (20 lb. $\times$ 454,000 mg. per lb./10 mg.) = 2.23 cc. Therefore, the time t, required to achieve the desired level of dispersion, is given by $0.9 = 1 - [e^{2.045\,(1-1.109^t)}]^{\frac{2.23}{25}}$. Rearranging, $(2.045 \times 2.23/25)(1 - 1.109^t) = \ln 0.1$ and $1.109^t = 1 + (2.3/0.1825$. Solving for t we have $t = \log 13.62/\log 1.109 = 25$.

It would therefore take approximately 25 min. of mixing to attain the desired degree of dispersion of the salt solution in the organic oil layer.

Ethyl Chloride from Waste Material

A UNIT costing $75,000 and employing a new process for making ethyl chloride, one of the most important chemicals used in manufacturing ethyl fluid for high octane gasoline, is now under construction at the Ethyl Corp.'s Baton Rouge, La., plant. This process yields ethyl chloride by reacting chlorine with waste material from one of the present ethyl chloride units and was developed to relieve the shortage of both alcohol and ethylene which are used in the two present methods for making this product.

While the principal use of ethyl chloride is for the production of tetraethyl lead used in ethyl fluid, it is also useful in production of ethyl cellulose, as a catalyst in synthetic rubber manufacture, and as an anesthetic in dentistry.

The two methods already in operation for making ethyl chloride are: (1) chlorination of alcohol in which ethyl alcohol vapor combines with hydrochloric acid in the presence of a catalyst to form ethyl chloride and water, and (2) chlorination of ethylene in which ethylene gas is mixed with hydrogen chloride gas in the presence of a catalyst. The two gases first are passed through a reactor where chlorination occurs, and later through a flash drum which distills off the lighter ethyl chloride fractions, leaving the heavier polymers.

Because of the enormous amounts of ethyl chloride used in making ethyl fluid, this company is both a large producer and consumer of the compound. Before the war, all of its electolytic chlorine was converted to hydrogen chloride for making ethyl chloride, as described above, and even additional chlorine was purchased elsewhere. Due to the wartime scarcity of chlorine, sodium was over-produced and stored in 1941 to obtain more chlorine. With ever-increasing demands for tetraethyl lead it was necessary to substitute hydrochloric acid for chlorine to produce ethyl chloride by the alcohol process.

As the war progressed, ethyl alcohol became extremely critical, and the supplies of ethylene, even after the construction of additional plant facilities, became inadequate to meet the needs for greater production of ethyl chloride. With this new process for utilizing waste products to make ethyl chloride, however, it is expected that all the requirements will be met without further drain upon available supplies of alcohol and ethylene.

HUMPHREYS SPIRAL

Another Tool for Process Industries

The recently developed spiral concentrator, which uses a form of centrifugal separation, is proving a valuable tool in metallurgical processes. While its usefulness so far has been limited to the production of mineral concentrates, this separating device may well find application in other process industries. In the past, much equipment originally built for metallurgical use, such as certain types of classifiers and filters, was later adapted to a variety of chemical processes. Hence we offer this abstract from recent pages of *Engineering & Mining Journal* so that chemical engineers may evaluate this novel device in terms of their own particular needs.—*Editors*

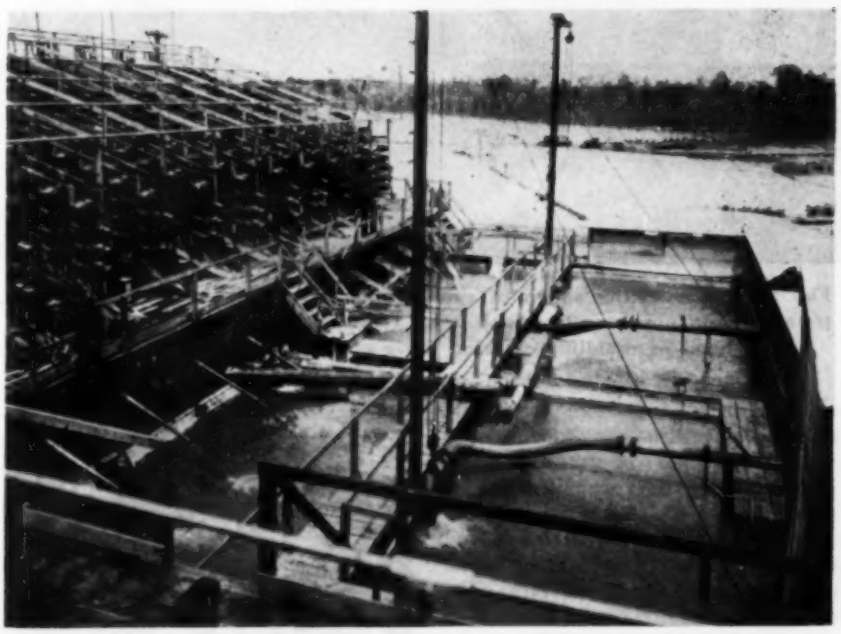


Fig. 1—5,000-ton rutile and ilmenite spiral concentration plant near Jacksonville, Fla.; tanks in foreground control feed density

ALTHOUGH the Humphreys spiral* was designed to recover fine gold from placer mine tailings, the mine closing order in 1943, coming at the time when this device was being perfected, prevented its commercial use in this field. First used on a large scale to concentrate chromite from marine sands in Oregon (not operating at present due to changing war requirements), this device has since been tested and applied in a number of operations, the most important of which is the production of titanium minerals, rutile (TiO_2) and ilmenite ($FeTiO_3$) from deposits near Jacksonville, Florida. Wherever spirals have been suitable, they have replaced tables and flotation cells to effect a large saving in space requirements, labor, power cost, maintenance, and at the same time produce a better grade of concentrate.

By a simple enough application of centrifugal force, consisting of passing pulp through a system of spiral launders, metallurgical results have been achieved which equal or surpass those of orthodox methods, and a remarkable degree of simplicity has been maintained. In design the spiral concentrator somewhat resembles the spiral picker used at some coal cleaning plants, in which dry coal, being approximately rounded in shape, slides down the chutes faster than the flat slate and therefore works to the periphery of the spiral and discharges separately from the slate. The opposite effect, however, takes place in the Humphreys spiral, which is explained in further detail below.

WHY IT WORKS

Examination of the theory of operation of the Humphreys spiral concentrator, according to Gleeson*, indicates why a device of such simplicity is capable in certain instances of a higher efficiency than more elaborate equipment.

As water flows down the spiral channel of modified semi-circular section, each element is subjected to a centrifugal force, tangential to the channel, directly proportional to the square of the velocity of flow and inversely proportional to the radius at which the element is located. This centrifugal force piles water up on the outer rim of the spiral until the flowing stream reaches an equilibrium between centrifugal force outward and gravitational force downward. Once established, the position of the stream is fairly constant for uniform pitch and radius.

Velocity of the spiral stream decreases with depth from its maximum just below the water surface, until it approaches zero velocity at contact with the channel. The largest percentage decrease in velocity will occur nearest the channel contact.

In any curved channel, whether a pipe or a river bed, the bottom layer of water, retarded by friction, has much less centrifugal force and consequently will flow sidewise along the bottom toward the inner bank of the curved channel, carrying with it the heavier particles of sand. Simultaneously with this bottom flow of water inward, the upper mass of water must flow outward to replace it. There is, consequently, besides the flow of water down the length of the spiral, a flow of decreasing velocity downward and across the channel to the inside, then upward and

* Gleeson, *Eng. & Min. J.*, pp. 85-6, March 1945; Humphreys and Hubbard, *Eng. & Min. J.*, pp. 82-4, March 1945; Huttl, *Eng. & Min. J.*, pp. 68-70, October 1943.

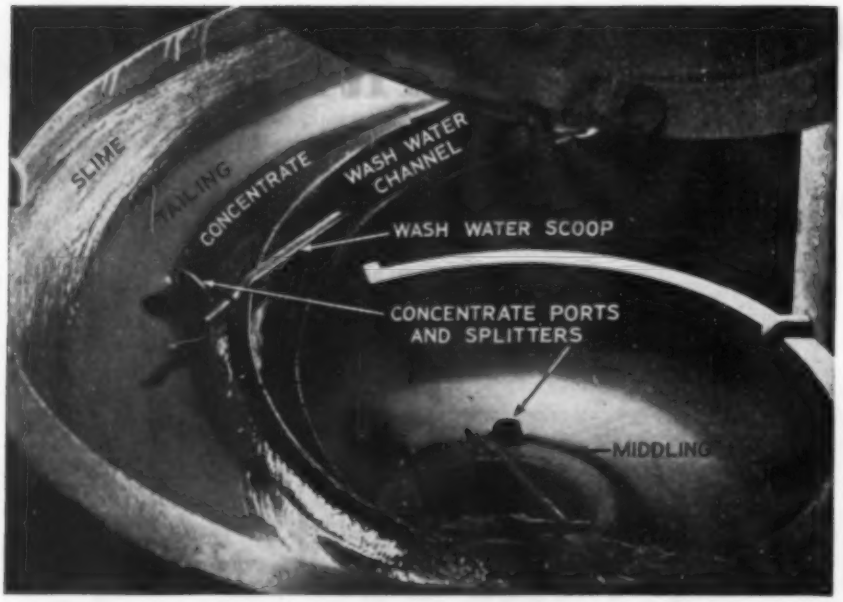


Fig. 2—Concentrating action of spiral; note wide black band of concentrate entering upper outlet which is set for a wide cut; also narrow black band of middling entering lower outlet set for thin cut

across the channel to the top, progressively increasing in velocity until friction again enters.

The foregoing rather complicated movement of the flowing stream has been well established as existing at all bends, and the spiral is simply an exaggeration of the more commonly encountered case. The several flows and forces combine to sort and concentrate any particles which may be suspended in the stream. Oddly enough, a limited size classification also takes place.

Fig. 4 illustrates a section of the spiral and the flowing stream. The "double spiral action" in the flowing stream produces, as a final result, an arrangement of particles of variable densities that is common to flowing-film type concentrators.

This arrangement has been indicated as concentrate, middling, and tailing. Particle size, within limits, is not a critical factor, and no particular advantage is gained by prior classification. Once the arrangement has been established, it is a simple matter to remove concentrate and middling through suitable openings located near the inner radius of the spiral.

For particles of lower density, which sometimes are not entirely lifted into the main stream at the inner radius of the spiral, wash water is added at the inner edge of the stream. This wash water tends to wash off lighter material riding on the surface of the heavier and return it to the concentration zone. Adjustment of amount and direction of wash water and of a small deflection splitter, which is attached at each concentrate outlet, are the only controls required to produce a higher —or lower—grade outlet product in larger or smaller amount.

It is interesting to note the rapidity with which the concentration pattern is established. In operation as a rougher unit upon chrome bearing sands, a concentration ratio of 2.31 to 1 was established in three-quarters of a revolution of the spiral and with a recovery of 58.4 percent of values at this point. At one full turn (second concentrate outlet), the concentration ratio was 2.07 to 1 at 90.7 percent recovery. Over-all results for the battery gave a concentration ratio of 2.25 to 1 at 98 percent recovery. Records for a seven-month period indicated a capacity per spiral for the above unit of 37.9 tons of raw feed per 24-hr. day, based upon an average head grade of 6 percent Cr_2O_3.

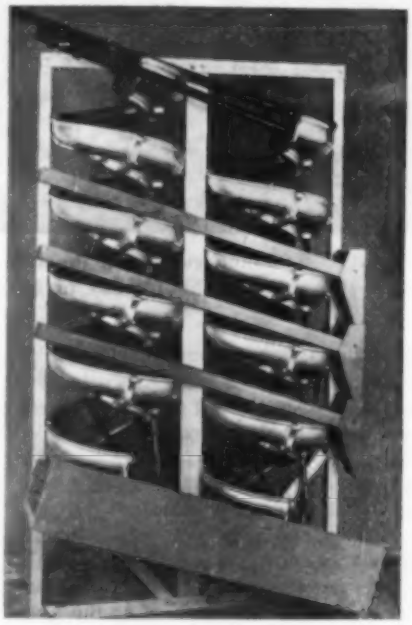


Fig. 3—Spiral units are arranged like this; concentrate launders are at the top; tailing launder at the bottom; wash water trough is on inner side of spiral

From the foregoing considerations it might be inferred that, as with tables, surface roughness and the corresponding change in film velocity might be important variables. Experience does not bear this out. It is presumed that the bedding of the solid particles along the bottom of the channel, and their motion relative to the water stream, control the bottom "roughness"; hence, artificial roughness is ineffective.

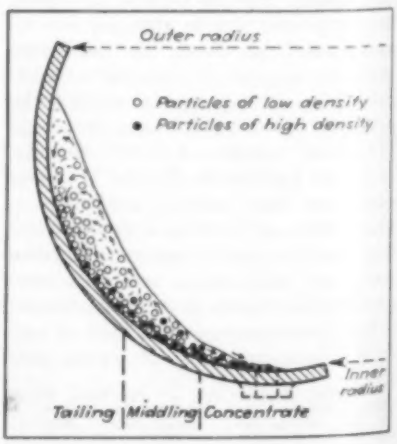
Finally, it might be mentioned that the spiral units are not particularly sensitive to changes in the flow stream. Pulp densities, quantity of head feed, shape or size of particles, richness of heads, and other variables, can fluctuate over rather wide ranges without affecting recovery or grade. In some cases prior removal of colloidal slimes improves concentration. Once adjusted, the spirals need little attention if plant fluctuations are within usual limits.

While the spiral concentrator is finding use in various processes, the only complete installation at present is at the Rutile Ilmenite Div. of Humphreys Gold Corp., Jacksonville, Fla., the arrangement of which is shown in the flow sheet. This plant uses 174 rougher spirals, 36 cleaner spirals, and 12 finishing spirals for primary concentration in treating about 5,000 tons of sand daily.

HOW IT OPERATES

Feed to the spiral, or wet plant, as it is called, contains amounts of heavy minerals varying from 5½ to 11 percent, most of which are found in the finer sizes. The percentage of recovery in the spiral plant of the valuable rutile and ilmenite contained in the feed is over 95 percent and

Fig. 4—Showing how water flow along spiral bottom brings heavy mineral to concentrate outlets; reverse flow above carries lighter mineral up



this fraction makes up about 92 percent of the concentrate. The heavy mineral concentrate from the spirals is dried and then fed to an electrostatic and electromagnetic separation plant that produces a rutile and ilmenite concentrate.

Most important elements in control of the spiral plant are the feed tanks, one to receive washing plant product and one to receive rougher concentrate. Both tanks act as surge, as well as feed tanks, and are large enough to provide ample storage space for intermittent delivery from the digging and washing equipment.

As shown in Fig. 6, pulp is removed from the tank in the annular space between two concentric pipes set vertically just above the "vertex" of the tank bottom. The inner pipe, which carries a flow of fresh water, can be raised or lowered to control the rate of feed and density of the pulp delivered. Water is pumped down the inner pipe and a suction pipe lifts the agitated pulp through the annular space between inner and outer pipes and delivers it to the spiral distribution system. Pulp density is decreased by raising the inner pipe and increased by lowering the inner pipe. This change in density is the principal operating adjustment in control of the spirals after they have been regulated in starting up the plant. Variations in grade of feed and in tonnage throughout require only occasional checking and adjusting of individual spirals.

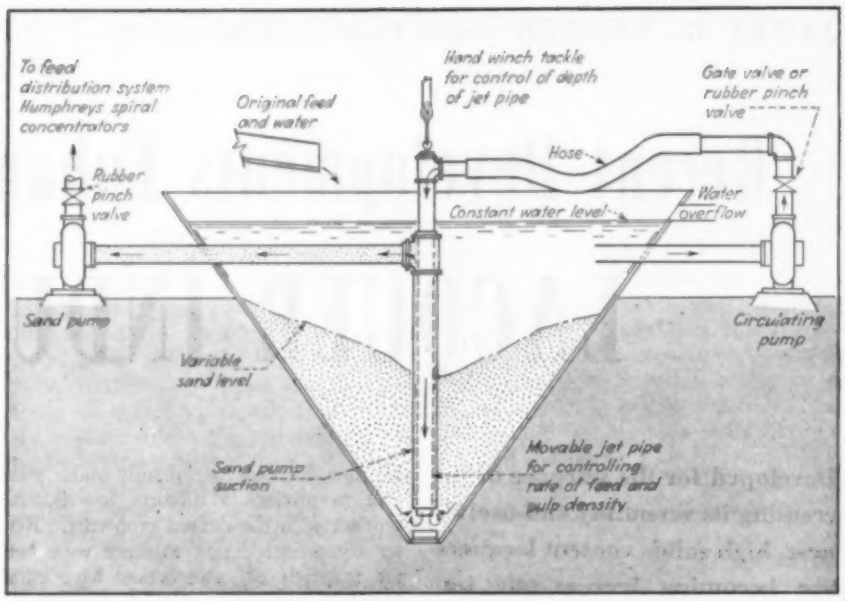
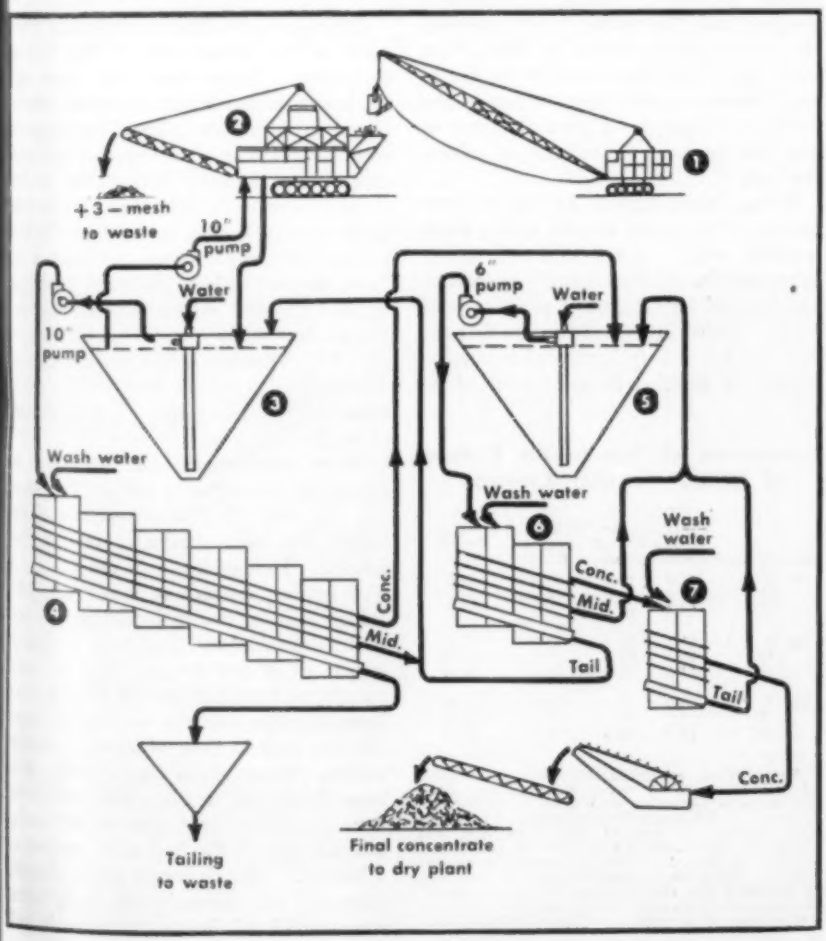

To feed distribution system Humphreys spiral concentrators
Original feed and water
Hand winch tackle for control of depth of jet pipe
Gate valve or rubber pinch valve
Hose
Rubber pinch valve
Constant water level
Water overflow
Sand pump
Circulating pump
Variable sand level
Sand pump suction
Movable jet pipe for controlling rate of feed and pulp density

Fig. 6—Feed tank adjustment controls density of pulp and flow rate

Fig.5—Flowsheet of rutile-ilmenite concentration plant using batteries of spirals for roughing, cleaning, and finishing

1. Electric or diesel powered dragline. 2. Hopper feeding trommel screen. 3. Feed tank, inverted pyramid shape for rougher spirals. 4. Rougher spirals. 5. Feed tank for cleaner spirals. 6. Cleaner spirals. 7. Finishing spirals, fed by gravity



Distribution of pulp among the spirals is accomplished by a simple arrangement of distributor heads and branching pipes so that a uniform feed goes to each of the spirals. The feed to the 12 finishing spirals, however, flows direct by gravity with some makeup water added. About 2,000 g.p.m. of makeup water is used. The surge tanks provide recirculated water for screening, washing, pumping, and concentrating. Pulp density of the feed to the spirals is from 25 to 30 percent solids by weight and 5,000 tons of sand is treated per day.

One of the important features of the spiral concentrator is its small size. In one chromite concentration plant where spirals were used to replace tabling and flotation equipment a 75 percent saving in floor space requirements was made. In addition to this, the operation requires practically no supervision after the feed rate and the auxiliary control devices have been set, and because there are no moving parts the maintenance and power costs are small.

NEW POSSIBILITIES

While there have been thus far only two large scale commercial installations of the Humphreys spiral, for chrome ores and titanium ores, test work is being carried out on many materials. These include fine anthracite and bituminous coal, Mesabi iron ore washer tailings, lead-zinc-gold-silver ore, tungsten ore, vermiculite, tin ore, and various ores of mica. A small plant in Colorado now uses the spiral to separate lepidolite and microlite, and other plants have been testing or using spirals.

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Recent Developments Enhance Future of LACQUER INDUSTRY

Developed for the purpose of increasing its versatility and usefulness, high solids content lacquers are becoming increasingly important in the protective coating industry. Already recognized as the fastest durable air-dry finish, these new lacquers should prove the basis for increased consumption of such chemical products as nitrocellulose, alkyd resins, and various cellulosic materials. Progress in lacquer development is herein interpreted and evaluated.—*Editors*

NITROCELLULOSE as a chemical raw material for protective coatings has made spectacular strides in the past 25 years. Usage of nitrocellulose in lacquer increased from about 2,000,000 lb. in 1919 to over 36,000,000 lb. in 1941, during which period lacquer production increased correspondingly to occupy a substantial position in the protective coating industry. Improved methods and equipment for both production and application have played an important part in this growth. The latest step, development of lacquers having high solids content, should prove the foundation for another substantial increase in the volume of nitrocellulose used by the finishing industries.

At the close of World War I, the chief use of nitrocellulose was in belt cements, metal lacquers, and dopes for airplane fabrics. The usefulness of nitrocellulose was limited because its viscosity was so high that solutions were very viscious, or if thinned to a low viscosity, the solids content was so low that many coats were required to give a film having sufficient protective properties. The need for low-viscosity, high-solids lacquers resulted in the development of improved processing methods in which the nitrocellulose fibers are now digested continuously under pressure to produce a uniform low-viscosity product with the desired properties. Better equipment design together with better materials of construction have combined to improve quality of product, increase efficiency of operation, and decrease maintenance costs.

Application methods, too, have undergone many changes which have contributed to the successful growth of this industry. The versatility of this coating material is well demonstrated by the variety of methods of application such as brushing, dipping, flow-coating, tumbling, roller coating, knife coating, and spraying. Newer methods including electrostatic spraying and "de-tearing," hot spraying, etc., (discussed in *Chem. & Met.*, Nov. 1944, pp. 123-4) have made it possible to apply heavier coats, thus reducing the number of layers for a given thickness of film and lowering the amount of solvent required.

Nitrocellulose lacquer has always been known as the fastest durable air-dry finish available, which makes it ideal with respect to economies of floor space, equipment, and material investment. Successive coats can be applied in a short time so that the dirt and lint pick-up is reduced to a minimum. In addition to these practical assets, the color possibilities, high gloss, and good appearance, together with ease of touch-up and repair make it a desirable finishing material. In the past, the principal weakness of lacquer was low-solids content but this has been partially overcome by using low-viscosity nitrocellulose and improved methods of application as described above. Recently, however, new formulations have utilized various combinations of solvents and diluents, in addition to improved types of alkyd resins and low-viscosity nitrocellulose to increase further the non-volatile composition.

Comparison of Non-Volatile Content of 80-Cp.[1] Viscosity Lacquers

Ratio[2]	Solvent[3]	RS ½ Sec.,[4] Percent Solids	RS ¼ Sec.,[4] Percent Solids	RS 30-35 Cp.,[4] Percent Solids	RS 18-25 Cp.,[4] Percent Solids
1:1	I	17.0	20.5	21.5	23.0
	II	19.8	24.0	24.8	26.5
	III	23.4	28.5	29.9	31.6
1:2	I	21.2	25.1	25.6	27.0
	II	25.3	28.8	29.5	31.4
	III	31.3	34.6	36.5	37.3
1:3	I	24.1	27.8	28.5	30.0
	II	28.2	33.0	33.6	34.8
	III	33.9	38.5	39.0	40.4

[1] Maximum spraying viscosity. [2] Ratio of nitrocellulose to resin; nonoxidizing type alkyd resin (Aroplas 905) used in all formulations. [3] Solvent formulations: I (standard solvent 25 deg.C.) butyl acetate, 35; butanol, 15; toluene, 50 percent. II (high solvency, 25 deg.C.) butyl acetate, 20; ethyl acetate, 10; methyl ethyl ketone, 30; toluene, 30 percent. III (hot spray, 70 deg.C.) butyl acetate, 37.5; butanol, 12.5; denatured alcohol, 10; xylene, 40 percent. [4] Type and viscosity of nitrocellulose.

KEY TO HIGH SOLIDS

Extensive development work has been done in the laboratories of the lacquer companies. More than two years ago work was started in the Hercules laboratories to formulate high-solids lacquers combining the good features of the oil conventional lacquers with those of the resins.[1] The work was carried on in two parts, namely, finishes for automobiles and similar metal applications, and finishes for furniture and other products made of wood. The five general factors which influence the solids or non-volatile content are: (1) Viscosity of nitrocellulose, (2) solvents used, (3) ratio of nitrocellulose to resin, (4) resins used, and (5) temperature of application.

Since nitrocellulose has the most influence on viscosity of a lacquer, the lower the viscosity of the nitrocellulose the higher the solids obtainable in the final lacquer. This is shown in the table. A high solvency system was chosen, one with a high ratio of low molecular weight solvent to the diluent. The lower molecular weight esters and ketones, such as ethyl acetate, acetone and methyl ethyl ketone, have a greater capacity to disperse nitrocellulose than do those of higher molecular weight. Since resins in general have lower molecular weights than nitrocellulose, increasing their ratio to nitrocellulose will increase the final solids content of a lacquer. The choice of lower viscosity resins will also increase solids. Both factors were considered in the tests conducted.

These formulations were sprayed both at room temperature and at 70 deg. C., with necessary solvent changes being made.

In the clear metal lacquers, 1,100 formulations indicated that lacquers of 30-35 percent solids could be sprayed cold and have good durability and appearance. The hot spray application will raise these solids higher (35-40 percent). Test panels were checked for hardness and resistance to cold check, high humidity, water spot and outdoor exposure.

EXTENSIVE TESTS MADE

Work to date indicates that high quality lacquers can be formulated with nitrocellulose of viscosities as low as 27 centipoises as shown by test panels exposed six months in Florida with an additional three years in Wilmington, Del.[2] Pigmented panels now under test in Florida for six months have shown no difference in durability between RS ¼ and ½ second, 30-35 centipoises and 18-25 centipoises. Further exposure may bring out differences. It has been noted that blush resistance is improved as the percent of nitrocellulose is increased.

In these tests nitrocellulose was combined with: (1) Nonoxidizing alkyds, (2) oxidizing alkyds, (3) blends of these two types of alkyds, and (4) blends of nonoxidizing alkyds with nonalkyds, such as urea formaldehyde and melamine-formaldehyde resins. A high ratio of resins to nitrocellulose, 4:1 or higher, had a tendency to give soft films with excessive abrasion and dirt pick-up which were more sensitive to water. The hard nonalkyd resins in combination with the nonoxidizing alkyds increased the hardness of the film without too much reduction in the resistance to cold check and outdoor exposure. However, resistance to humidity was not particularly good, even though this combination does give somewhat higher solids. In general, the oxidizing types of alkyds have a tendency to lift on second coat applications when combined with nitrocellulose alone but this difficulty was generally overcome by using combinations in which the nonoxidizing resin exceeded the oxidizing alkyd. This combination gave better hardness at a higher solids content.

Another interesting observation was the effect of a small amount of solvent type plasticizer such as dibutyl phthalate added to a 1:1 mixture of nitrocellulose and nonoxidizing alkyd. It had a moderate softening effect but satisfactory hardness still existed. The cold check was increased from 5 cycles to 25 plus in several formulations. Improvements were also noted in humidity and exposure resistance.

This work would indicate that a testing program to produce a general formulation of average qualifications in all tests should start with equal parts RS ¼-sec. nitrocellulose, or possibly lower, and a nonoxidizing alkyd resin balanced with a plasticizer or hard resin for the desired hardness and flexibility.

From the extensive work done in the metal lacquer program, it was possible to select certain types of formulation which possessed the characteristics desired for wood finishing. Further tests were made to evaluate resin to nitrocellulose ratios as high as 4:1. Oxidizing alkyds, nonoxidizing alkyds, and nonalkyd hard resins were tested in various combinations. Various plasticizers were used such as dibutyl phthalate, dioctyl phthalate, tricresyl phosphate, triphenyl phosphate and castor oil. In all these tests special attention was given to such properties as print and cold check resistance, hardness and ability to be rubbed and sanded.

EXPERIMENTS LEAD WAY

These tests indicated that good quality, air-dry lacquers could be made with 30 to 35 percent solids for normal temperature application and 35 to 40 percent solids at elevated temperatures. For applications having less rigid quality specifications even higher solids could be sprayed satisfactorily. These better formulations were combinations of nitrocellulose, nonoxidizing alkyds, hard resins and plasticizers. With the resins tested, increased amounts of nitrocellulose gave films having better print and cold check resistance. No doubt better resins will be developed which will make nitrocellulose lacquers of still higher solids content possible.

The experimental results to date indicate that high-solids nitrocellulose lacquers can be formulated which should have wide usage in the peacetime markets. Further improvements will certainly be made by the various laboratories now doing research along these lines. This applies to equipment and raw materials as well as to the combination of these materials. Much interest and work is evident along the lines of improved hot spray equipment. Work is being done by the resin manufacturers to produce a resin particularly adapted to nitrocellulose lacquers. A nitrocellulose has been developed that possesses a better solubility in solvent mixtures having less of the ester solvents. An alcohol-soluble nitrocellulose (SS type) has found wide usage. In addition, progress is being made along the line of tailor-made lacquers. Examples are fungus-resistant lacquers, flame-resistant coatings, and fluorescent or luminescent finishes.

Certainly with all these developments and outlets, the end of World War II should mark the beginning of lacquer expansions similar to those made during the period following World War I.

Milliken continuous digester for producing low viscosity nitrocellulose

By this process, nitrocellulose fibers suspended in water are pumped through approximately 4/5 of a mile of chrome steel tubing. The slurry first passes through a steam jacketed section for heating, then through an insulated portion where digestion is completed and finally through a water jacketed section for cooling before discharging into receiving tanks. Instead of the heavy inactive mass present in the batch digester, the fibers are continuously in motion which results in more uniform treatment with each fiber near the desired viscosity, rather than a blend of wide viscosities. To the lacquer field this means tougher, more durable films with lower viscosity type of nitrocellulose, making it possible to raise the solids content of lacquers.

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1. Wm. Koch, H. C. Phillips, Rufus Wint, *Ind. Eng. Chem.*, 37, Jan. 1945, pp. 82–6.
2. Wm. Koch, *Ind. Eng. Chem.*, 36, Aug. 1944, pp. 756–8.

A. E. BADGER and R. H. BRAY *Department of Ceramic Engineering, University of Illinois, Urbana, Ill.*

SOLUBLE GLASS

May Offer Fertilizer Possibilities

Possibility of providing all the elements necessary for plant growth except for nitrogen, water and organic material, in the form of a glass of controlled solubility, is suggested by work carried out by the authors on the solubility of fused mixtures of rock phosphate, potassium carbonate and silica. Other fertilizer elements can also be provided in glass form. Should proper solubilities be obtainable with the more complex mixtures and costs be competitive with present fertilizers, "glass fertilizers" may offer interesting advantages.—*Editors*

IT IS a curious coincidence that, with the exception of water, organic matter, and nitrogen, all of the elements required for plant growth may be incorporated in a glass. The major chemical elements, as potassium, calcium, magnesium, and phosphorus, as well as the minor elements needed by plants—as sulphur, iron, boron, zinc, manganese, and copper—may be included in the glass structure. This fact, coupled with the knowledge that glasses may be made with varying resistances to solution by water, suggests a method whereby plant nutrients may be made available to the plant without danger of "burning" it, by a choice of a suitable glass composition which has the desired rate of disintegration. The ease with which glass can be manipulated suggests many commercial adaptations for soil-less growth experiments as well as ordinary applications for soil enrichment. For example, nutrient glass may be pressed into various shapes, as flower pots or blocks of various sizes; surfaces with large areas exposed to the soil may be formed readily by grinding the glass into powder or by blowing it into glass wool.

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EFFECT OF HEAT

When crystalline materials are heated sufficiently to form glasses, the lattice structure is destroyed. Thus, many rocks may be used as raw materials in the glass batch and become more readily available for plant growth. For example, feldspar may be used as a source of potassium; rock phosphate as a source of phosphorus; olivine[1] as a source of magnesium, etc.

The following experiments deal with the decomposition of rock phosphate,[2] in which the primary mineral is fluorapatite, $Ca_{10}(PO_4)_6F_2$. Since the phosphorus in this mineral is not readily available for plant growth, various chemical treatments[3] have been resorted to in order to break down the crystalline structure. The first part of the following account deals with experiments in which the desired decomposition of rock phosphate was effected by incorporating it in a glass.[4]

As an outgrowth of melts made at high temperatures (ca 1,350 deg. C.), two series of trials were made at lower temperatures (800 and 1,100 deg. C.), where the problem of refractory corrosion is not serious. It was shown that mere sintering of rock phosphate with K_2CO_3 and silica is sufficient to destroy the crystalline structure and produce a more soluble phosphate.

FUSIBILITY AND SOLUBILITY

An investigation of the fusion of various mixtures of rock phosphate with potash and silica[5] was made by heating the mixtures in platinum crucibles at about 1,350 deg. C. The compositions of the samples are shown on a triaxial diagram in Fig. 1. Those mixtures which solidified to glasses on cooling comprise a central area in this diagram; compositions which were low in potash were merely sintered and are shown in the "high melting area;" compositions low in silica were found to be hygroscopic.

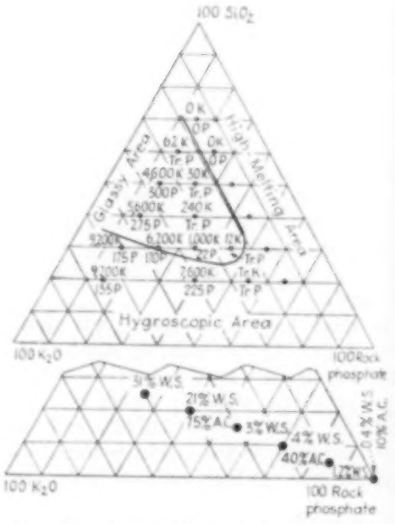

Fig. 1—Compositions of trial melts at 1,350 deg. C., showing solubility in p.p.m. of potassium, labeled K, and phosphorus, labeled P

Fig. 3—Additional tests of solubility of rock phosphate mixtures sintered at 800 deg. C.

In order to compare the solubility of the fusions, 2-gram samples were powdered and placed in bottles with 100 ml. water, after which they were steeped for 90 hours at 70 deg. C. Analyses of the supernatant liquid showed varying amounts of potassium and phosphorus which are denoted as parts per million in Fig. 1. The greatest amount of phosphorus in solution was 300 p.p.m., which was found in a mixture of 15 parts rock phosphate, 35 K_2O, and 50 SiO_2. Several other mixtures

[1] Cf. J. H. Walthall and G. L. Bridger, *Ind. Eng. Chem.*, 35, 774-777 (1943). *Cer. Abstracts*, 22, 182 (1944).

[2] Rock phosphate in these tests was obtained from the Rubm Co. (Bag F; July 1927; Code No. F299).

[3] For example: the formation of acid phosphate by treatment with sulphuric acid; the treatment of rock phosphate with water vapor at high temperatures (K. D. Jacob, *et al.*, *J. Agricultural Research*, 50, 837-848, 1935).

[4] Fusion of phosphate rock with alkali carbonates and silica at 1500° C. is used to manufacture the product called "Supertomanyna". See *Chem. Abstracts*, 30, 6875 (1936).

[5] Potassium carbonate and potter's flint were used as raw materials in these tests.

showed appreciable solubility of both phosphorus and potassium.

SOAKING PERIOD EFFECT

Fusions of various compositions were powdered and ¼-gram portions placed in stoppered bottles with 50 cc. of water. At the end of a 5-hour soaking period at 70 deg. C., a small quantity of solution was withdrawn for analysis of phosphorus and potassium. The samples were then soaked for an additional 88-hour period, after which the solutions were again analyzed.

The results of the chemical analyses, which are given in the accompanying table, showed in general that the phosphorus in solution decreased markedly as the soaking period increased, while potassium usually increased. These changes with time may be explained by a reaction among the various ions which exist in the solution. As the fusion slowly dissolves, phosphate ions and ions of potassium and calcium are formed from the siliceous fusion. Increase of soaking period causes an increase in the potassium content of the solution until solution is complete. However, the phosphate ions in the solution are precipitated by calcium ions which are slowly formed from the siliceous glass, thus causing a decrease in the amount of water-soluble phosphorus.

FUSION TEMPERATURE EFFECT

A serious difficulty in the commercial development of methods for producing soluble phosphate by fusion of mixtures lies in the intense corrosive action of phosphate melts on refractories. In order to decrease the amount of this attack, the temperature of fusion should be kept as low as possible.* To study the effect of fusion temperature, various mixtures of

Fig. 2—X-ray diffraction patterns showing at *a*, rock phosphate; at *b*, mixture heated to 800 deg. C.; at *c*, potassium carbonate alone

Potassium and Phosphorus Dissolved After Various Soaking Periods

(¼-gram samples in 50 ml. water)

Sample Number	Temp. of Heat Treatment, Deg. C.	Composition, Percent — Rock Phosphate	Potter's Flint	K_2O	Phosphorus, P P.M. After 5 hr.	After 93 hr.	Potassium, P.P M After 5 hr	After 93 hr.
32	800	35	30	35	25	12	1,100	1,375
32	1,100	35	30	35	16	17	290	410
46	800	35	15	50	24	13	1,550	1,550
46	1,100	35	15	50	63	4	1,700	1,650
46	1,300	35	15	50	30	15	1,830	1,380
47	800	50	15	35	10	12	sample lost	1,100
47	1,100	50	15	35	72	12	1,330	1,050
47	1,300	50	15	35	53	27	1,150	1,130
48	800	35	0	65	19	12	1,300	2,200
48	1,100	35	0	65	22	10	1,900	1,900
48	1,300	35	0	65	44	0	1,630	1,400
49	800	20	45	35	17	12	850	1,300
49	1,100	20	45	35	3	2	240	900

rock phosphate, K_2CO_3, and SiO_2, were heated at temperatures of 800, 1,100, and 1,300 deg. C., after which the solubilities were determined as outlined above. It was shown that in many cases the amounts of soluble phosphorus and potassium were greatest in samples heated at the lowest temperature (800 deg. C.). Furthermore, this low temperature does not cause complete fusion of the mixture, which is merely sintered. At this low temperature the problem of refractory corrosion does not exist.

This breakdown of rock phosphate at the low temperature of 800 deg. C. was verified by X-ray analysis. An X-ray diffraction pattern of rock phosphate is shown in Fig. 2a. After heating rock phosphate with potash and silica (Sample No. 32 consisting of 35 rock phosphate, 35 K_2O, 30 SiO_2, was chosen for this test) at only 800 deg. C., the characteristic pattern of rock phosphate has disappeared as shown in Fig. 2*b*, the new diffraction lines being those of excess K_2CO_3. The X-ray diffraction pattern of the latter is shown in Fig. 2c. Evidently the fluorapatite has become amorphous or gone into glassy solution and the resulting breakdown of the crystal lattice of the original substance produces soluble phosphorus.

In order to check some of the solubility tests which are illustrated in Fig. 1, another series of mixtures of potash, silica, and rock phosphate was heated at 800 deg. C. and solubilities determined. In this series, the amounts of silica were maintained at low values while rock phosphate was increased up to 100 percent. Fig. 3 shows the solubilities of phosphorus which were found in the sintered masses; these solubility values are stated as the percentage of the total phosphorus which was found in the soluble form.

One set of solubilities was obtained after the powdered material had remained in water for 24 hours; these water solubilities are denoted W.S. in Fig. 3. They show a regular increase with potash content except for one value (0.3 percent) which is unexplained.

* The authors are indebted to C. G. Harman for the suggestion of heat treatment at low temperatures. They are pleased to acknowledge also the aid of G. H. Johnson during the course of the experiments.

The other set of solubilities given in Fig. 3 was obtained in ammonium citrate solution (denoted A. C. in Fig. 3). Only three determinations were made; the highest value (at 40 K_2O, 20 SiO_2, and 40 percent rock phosphate) shows that 75 percent of the total phosphorus was dissolved.

These series of tests serve to verify some of the solubilities given in Fig. 1. Figs. 1 and 3 both indicate the formation of soluble phosphorus by treating mixtures of rock phosphate, silica, and potash at the relatively low temperature of 800 deg. C.

USE OF KCl

From the cost viewpoint, it would be preferable to utilize potassium chloride instead of potassium carbonate for the reacting alkaline material. The results of a series of tests at 875 deg. C. in which KCl was substituted for K_2CO_3 showed that only negligible amounts of soluble phosphorus were found and there appears to be slight promise in the use of KCl at low temperatures.

The foregoing account of experiments shows that rock phosphate may be changed to a soluble (plant-available) form by heating with potash with or without silica. These experiments suggest a method whereby desirable chemical elements can be incorporated in a glass which is decomposed by water.

A new development consists of low-temperature sintering (e.g., at 800 deg. C.) of rock phosphate with potash with or without silica to produce soluble phosphate. By this low-temperature heat treatment, the corrosion of refractories is avoided and possibility of commercial development is enhanced. Other fluxes await trial as agents which may break down the fluorapatite lattice in sintering experiments at comparatively low temperature. Furthermore, the substitution of K_2SO_4 or other suitable alkaline salts for the potash used in the foregoing experiments might be advantageous from an economic standpoint and such substitutions should not alter appreciably the amount of decomposition of the rock phosphate.

FROM THE VIEWPOINT OF THE EDITORS—

S. D. KIRKPATRICK, Editor • JAMES A. LEE, Managing Editor • THEODORE R. OLIVE, Associate Editor • HENRY M. BATTERS, Market Editor
J. R. CALLAHAM, Associate Editor • L. B. POPE, R. W. PORTER, E. C. FETTER, Assistant Editors • R. S. McBRIDE, Consulting Editor

"EVEN A WHEEL CHAIR"

DISPOSAL of surplus war plants will be carried out with the maximum effort to secure practical use of these establishments by private enterprise for the benefit of the public. This basic principle was made clear in the appearance of Chairman Guy M. Gillette of Surplus Property Board and Hans A. Klagsbrunn, deputy director of surplus property disposal through Defense Plant Corporation, who appeared before the Senate Small Business Committee discussing aluminum and magnesium.

Mr. Klagsbrunn emphasized the desire of DPC to make these government properties useful. He pointed out the difficulties of negotiating contracts for sale or lease. Finally he emphasized that DPC would go to great length in order to make it possible for industry to get busy with this surplus government property, saying that they would "provide crutches, or even a wheel chair" if necessary to help business get going.

These and other remarks are most encouraging to process industry executives who must undertake the extremely difficult task of formulating some kind of a proposal fair to the government and practical for their companies. It looks as though many of these contracts will start out as leases with options to purchase the plants when it has been proven that they can run effectively and profitably under postwar conditions.

It is much to be hoped that DPC working under Surplus Property Board will be able to carry out its present constructive policies. Especially all will hope that the Department of Justice and any political meddling of Congress does not prevent consummation of contracts of this sort. It will be hard enough for industry and DPC to get together on a fair deal. It will be infinitely harder if social theories are going to interfere with fairness in the dealings.

A PAT AND A PATENT

WASHINGTON is talking again about rewards for inventions made by government employees. Some people think that all such results from the spending of taxpayers' money should be made available for the free use of the general public. Others argue that patents should be taken, and that the government should control and issue licenses for the patents to secure the best use of the government results. Still others think that investigators should have full personal right of profit from exploiting their inventions.

Chem. & Met. has frequently argued that the public owns the results of investigations made by the government. Hence private exploitation of patentable results of government spending seems to us wholly improper. Nevertheless we do think that those who make meritorious advances by their inventions should get some recognition. At least they deserve the commendation of contemporaries both inside and outside of the government. We think that they perhaps should have a patent. That crystallizes definitely the claimed invention. And it permits orderly licensing by proper officials for commercial development.

Generalizations on the question are difficult, but we venture two. First, meritorious investigations should be appropriately commended whether the contributions are from federal or private source. Second, the government may patent; but it should not attempt official exploitation nor private exclusive use of such inventions, for they really belong to the public and private enterprise should be encouraged to use them for the public benefit.

WANT TO SHARE IN $2 BILLION?

INDUSTRY'S bill for containers will be approximately two billion dollars per year under postwar conditions as now estimated by the Department of Commerce. Chemical companies will supply not only essential materials but a very substantial proportion of the dollar value of this business. And the process industries, as usual, will be among the largest customers for containers, paying a big share of the total two billion dollar bill.

Few chemical engineers have realized that literally hundreds of millions of dollars of business every year are going to be found in the making of materials like pulp, plastics, adhesives, coatings, and the other components used in container manufacture. It is perhaps one of the largest unstudied fields of chemical engineering opportunity. It is a field in which there is a chance to get large new business if a superior packaging component can be made.

BITTER CONTROVERSY LOOMS

THE FERTILIZER industry now confronts one of the most difficult situations which is faced by any division of the process industries. It must combat an organized effort within the government to put government into business in competition with itself. If it does not successfully combat this threat, the fertilizer companies of the country are doomed to a competition that promises them very serious financial problems.

In last month's issue there was presented a summary of the recent developments which related primarily to potash. (See Watching Washington, p. 82.) The threat reported is but part of the organized effort in Interior, Agriculture, TVA, and a number of other agencies of the government. The composite is a program that must inevitably lead to having the government itself mix and market fertilizers on a cost-keeping basis which will give intolerable competition with private

enterprise that must keep its books, pay taxes, and carry out industrial affairs in a way that cannot be expected of government agencies.

National Fertilizer Association executives are aware of this problem. They are studying it conscientiously. Working alone they will not be able to combat fully the government effort, which now has the admitted organized support of at least American Farm Bureau Federation. The rest of industry, whether technical or otherwise, must watch and stand ready to help in the solution of these problems. The threat to free enterprise has never been greater. Even in the days when public ownership and public operation of public utilities was a major political issue, there was no greater threat to private enterprise.

We have no panacea to offer. But we shout our warning lustily.

A PERSONNEL BUNGLE

Civil Service rules from now on will not require college graduation for young men and women seeking positions as junior chemical engineer, junior chemist, or other junior professional appointment in the government. Especially a veteran with "three years of appropriate experience" will be rated as an acceptable applicant for these government jobs just as though he had graduated from a recognized four-year college course of study.

There is one advantage to industry in this bungling approach to veterans preference. It means that the government will no longer be so attractive to the boys who graduate from colleges. Industry will have a better chance than before to get them. The government service will be hurt. But the personnel officers of our companies will find themselves with a new advantage.

We hate to see the government take such a stand but we're glad to find a silver lining on the cloud which Civil Service Commission has spread over professional employment with Uncle Sam.

UNIFORM STANDARDS IN AMERICAS

In our travel through Latin America we were impressed time after time by the difficulty these countries have in trading with the United States due to differences in standards or the lack of standards. Hemispheric industry and trade stand to benefit by the adoption of uniform standards, particularly in such fields as equipment for chemical process industries, electrical purposes, and transportation. When uniform standards do not exist in these and hundreds of other categories, trade and industry are handicapped inasmuch as the equipment and other products of one country cannot be utilized in another.

An effort to solve the problems involved in the adoption of standards has been under way among a few of the countries for several years. The American Standards Association has been cooperating with established standardizing organizations in Brazil, Argentina, Uruguay, and Mexico, as well as with business concerns, government officials, and others throughout the Americas in the promotion of technical standards.

Now comes the announcement that the Inter-American Development Commission has formed a planning committee to make recommendations for an intensified program to encourage adoption of uniform technical standards throughout the Americas, as an aid to industrial development and trade. The committee will consider plans for an aggressive standards program and will recommend steps to be taken toward the formation of an organization to carry out the program, as was proposed in a resolution adopted at the First Conference of Commissions of Inter-American Development. This resolution provides for the establishment of the Pan American Standards Committee to be made up of representatives of each of the 21 republics.

If standards can be adopted by all of the countries of the Western Hemisphere, a troublesome barrier to trade relations among them will be removed.

LET'S SAY "FLAMMABLE"

Vigorous effort is being made by government, industrial, and organization spokesmen to secure greater use of the term "flammable." That word means easily set afire or readily combustible. There is no doubt in any casual reader's mind as to its meaning. Its use is far preferable to the more commonly used "inflammable."

Tradition never dies easily. It will be very difficult to get people to abandon the older word. But the use of such a word with its prefix "in—" has often made for confusion since that prefix often means "not." It would seem much wiser for all of us to use the terms "flammable" and "non-flammable." The meaning will be clear and the cause of safety will be correspondingly served.

WHAT IS PATENTABLE?

For several years research directors, and scientists and engineers generally, have been disturbed by a Supreme Court decision which seemed to require that a patentable invention be necessarily something that sprang from "a flash of genius." The use of that phrase in a court decision seemed to indicate that the Supreme Court was no longer going to recognize what had formerly been an accepted basis for defining patentability.

Those who were so much disturbed can now take comfort from a recent Supreme Court decision which again discusses rather more conservatively the basis of patentability. This discussion is presented in the decision under which Dow Chemical Co. is denied validity for its patent on the treatment of oil and gas wells with hydrochloric acid in order to increase output.

The Court points out, to its own satisfaction, that "it was perfectly plain to an expert" that certain patented claims should be true. And it therefore says: "Such a process lacks the very essence of an invention." It thus stresses the fact that adaptation of well-known practice to a somewhat different end purpose represents the use of normal engineering skill rather than the characteristics of invention.

This interpretation is undoubtedly very disappointing to Dow Chemical Co. But the reasoning presented does appear to have the great merit of recognizing, at least by inference, that the results of carefully considered research establishing new facts and new applications for facts may be invention. If this is true than many companies will feel much more safe in defending their patents than under the "flash of genius" theory which seemed to prevail in recent years.

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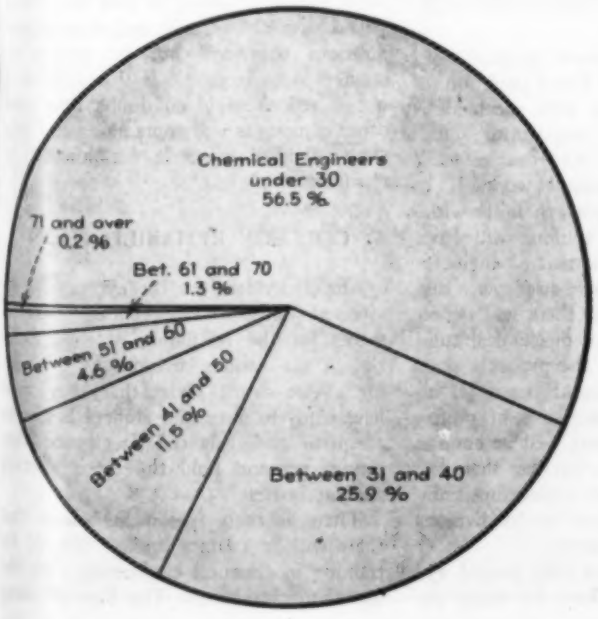
Chemical Engineers under 30 56.5 %
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Bet. 61 and 70 1.3 %
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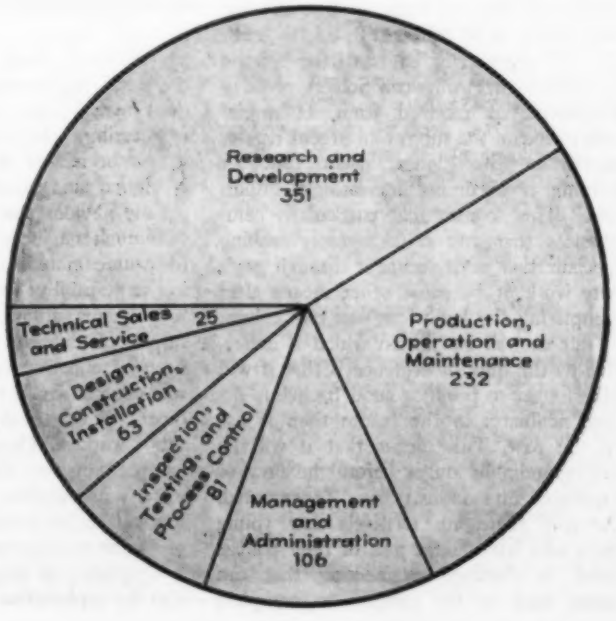
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Special students	23	6
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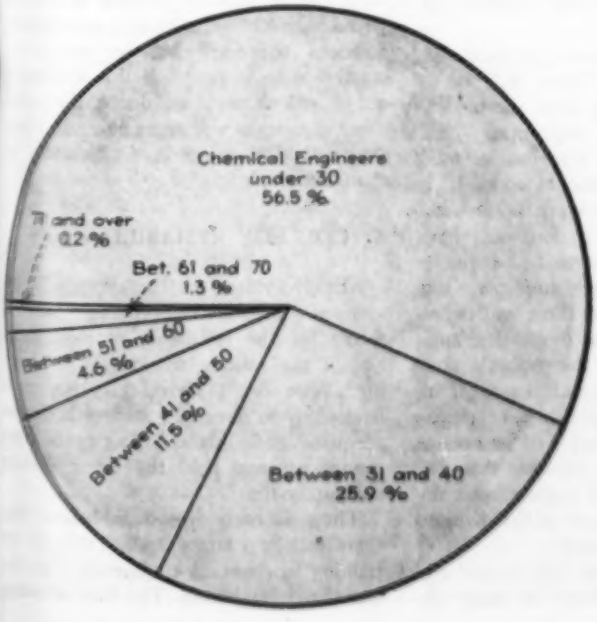
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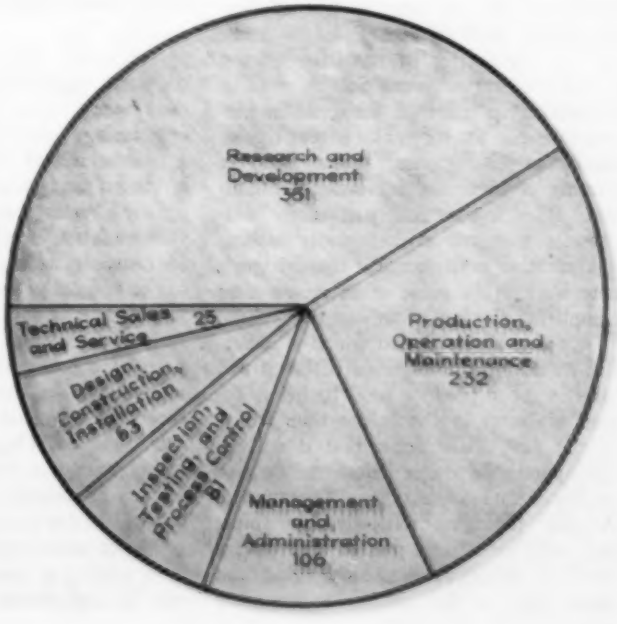
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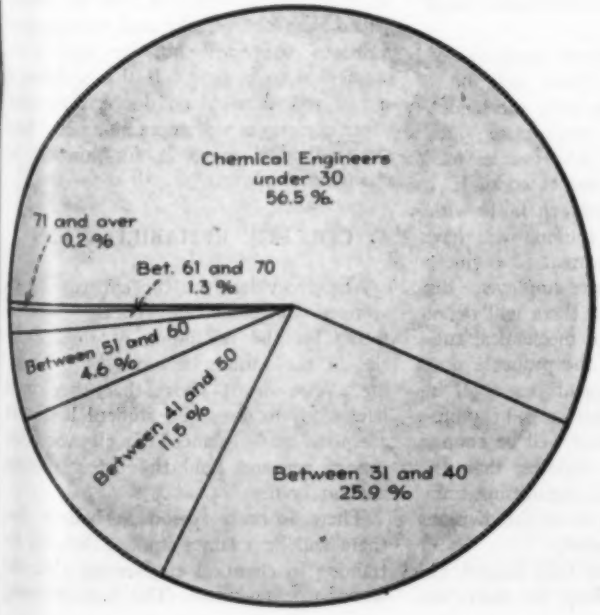
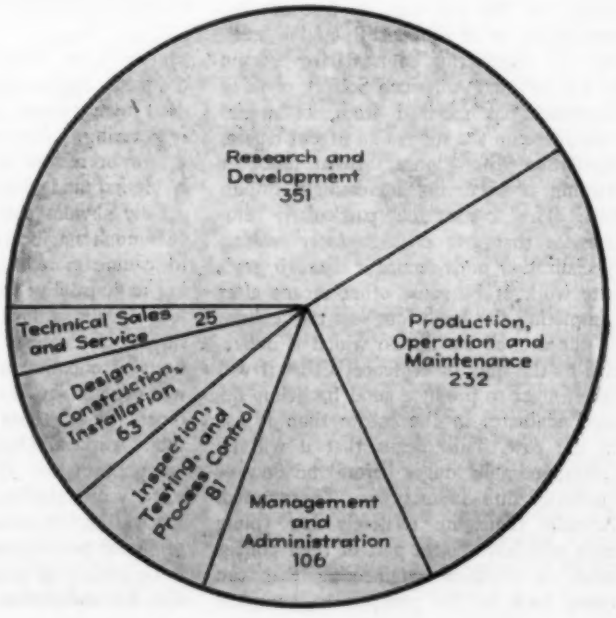
It seems reasonable to take the above figures, which appear more than conservative, as indicating that by the end of the active war period, one or two years from now, there will be an actual deficit of over 10,000 chemical engineers as compared

Age distribution of total Roster registrants in the field of chemical engineering. The median age of chemical engineers is 28.9 years


Chemical Engineers under 30 56.5 %
71 and over 0.2 %
Bet. 61 and 70 1.3 %
Between 51 and 60 4.6 %
Between 41 and 50 11.5 %
Between 31 and 40 25.9 %

Functions of chemical engineers in industry indicated by National Roster registrations per 1,000 registrations


Research and Development 351
Technical Sales and Service 25
Design, Construction, Installation 63
Inspection, Testing, and Process Control 81
Management and Administration 106
Production, Operation and Maintenance 232

with the normal supply for chemical enterprise.

POSTWAR CURRICULA

Industry is, or at least should be, seriously worried about the deficit in fully trained young professional men for postwar employment. This shortage will affect many different phases of industry. The accompanying table shows major functions served by chemical engineers, as evident from Roster records. It is clear that production, management, and research will all suffer seriously since those activities take nearly two-thirds of the total of professional workers in the chemical engineering field. But many other lesser activities will be adversely affected, assuming that the chemical engineer has been the best available man for the job which he has filled.

It is equally obvious that the colleges cannot speed up the training of chemical engineers by some magic method that will turn out properly finished graduates in months instead of years. As a matter of fact, the demands for thorough training are so much greater now than formerly that the time required at college is now longer than in the prewar period.

In the past it has been recognized on most university campuses that the chemical engineering curriculum was one of the most difficult of all four-year courses of study. This will continue to be true because a proper course requires thorough grounding in chemistry, almost a four-year job in itself, and a broad as well as fundamental training in the elements of several divisions of engineering. As a consequence, the average "good" student really needs five college years for full campus training.

Other divisions of engineering have felt the pressure for longer courses. Until recently this has not been so true of civil engineering as of others. But lately even the civil engineering courses have become so difficult that American Society of Civil Engineers has received from its special committee on the subject an urgent recommendation that longer than four-year training is becoming increasingly important. This committee particularly emphasizes that any civil engineer seeking specialization must secure it through graduate work or by some other means after completing the basic four-year curriculum.

The over-all conclusion which is indicative by the bulk of evidence is that it will take longer to produce good bachelors degree graduates in the future than it has in the past. This means that it will be correspondingly longer before the flow of graduates into industry can be resumed. Actually there are relatively few young men who have had a part of their college work in chemical engineering that can come back to the campus to complete their work in less than three years. Presumably, therefore, deficits in supply of graduates will be greater rather than less until at least 1950.

If the normal supply of raw material for the personnel department is to be less for some years to come, then procurement agencies of industry must look about for alternate sources of manpower. Several suggest themselves.

First and most obvious are engineers who have not been trained specifically in chemical engineering. There will be a great many young men with mechanical engineering, electrical engineering, and similar or related skills who can be used in design and development work. It is equally obvious that many chemists without much engineering training will have to assume more than normal of engineering responsibility for their employers. But it is equally certain that there will be no surplus of chemists or of mechanical engineers, if one can judge the probable postwar demand by the present clamor of industry to get these other sorts of professional workers. There may well be enough competition for their services that the scarcity of scientific and engineering training will be felt through all of the divisions of junior professional work.

Upgrading of men not fully trained will also be undertaken. There are many circumstances under which such persons will be able to offer very real aid as alternates for fully trained chemical engineers. Especially in the operating field it is entirely feasible by proper supervision and guidance to use a considerable period of experience instead of a shorter period of intensive professional training. But there are limits to which this can be done, especially in research, development, and design projects.

Perhaps more promising than either of the two possibilities first suggested is the possibility of spreading of skills. Frequently a well-trained chemical engineer will be able to do the specialized thinking for several jobs if he is given properly chosen and fully cooperative assistants. One fully trained engineer with a number of super-technicians will be able to do substantially more if working as a team than the same men would do working as separate individuals, each with his assigned part of a project. The main problem will be to get the super-technicians and find ways to fit them into a going organization. (The question of technician training is discussed later in this report.)

In general, it is going to be necessary for the management of technical enterprise to be sure that men with real fundamental training are not too much diverted into other activities until the time arrives that an adequate number of replacement men is available. This means that the chemical engineer can no longer be as freely used merely as a salesman or for general managerial and administrative jobs. His talent must be conserved for those tasks for which he is the only available man with full and fundamental training. This general management problem will bring with it a number of corollary questions. For example, it will be a question whether the compensation for full engineering service will not have to be made greater relatively so that in holding skilled men out of sales and management positions they will not be unduly restricted as to income. If this problem is not solved there is no doubt that some other companies will come along and help the individual solve it for himself by changing employers.

DISTRIBUTION OF CHEMICAL ENGINEERS*

Per 1,000 Registrants

CHEMICAL PROCESS INDUSTRIES	
Industrial chemicals n.e.c.	225
Petroleum refining	131
Explosives	40
Plastics	38
Rubber products	34
Paper and pulp	26
Synthetic rubber	25
Nonferrous metals	22
Food products	22
Drugs and insecticides	20
Glass, cement, clay, abrasives	19
Iron and steel	18
Paints, varnishes, colors	17
Oils, soap, glycerin	17
Rayon and other synthetic fibers	12
OTHER INDUSTRIES	
Machinery	35
Contracting	16
Instruments	15
Aircraft	14
Retail trade	11
Ordnance	10
GOVERNMENT AGENCIES (including war research on contract)	82
TEACHING	26
CONSULTING (full-time private practice)	6

*Indicated by National Roster registrations

COLLEGE REHABILITATION

Already evident are the efforts of long visioned university and college managements for the rebuilding of their faculties in the various divisions of engineering. Wise deans know that they must have ready to serve new student bodies an adequate and balanced faculty or they cannot get and hold the better postwar student bodies.

There is every reason to believe that there will be a larger student demand for training in chemical engineering after the war than ever before. The flow of young

men of 17 and 18 into college work will be resumed when military calls no longer take first place. There will be a substantial number of young men who will want to return to the campus virtually to begin a second time a college training with something of definite money-making objective. All engineering, but particularly chemical engineering, is likely to attract many of these young men who have had their college opportunity postponed by the war.

But the real deluge will come to the campus from the ranks of veterans who will come back with money jingling in their pockets as a result of the educational features in the G.I. Bill of Rights. A great number of these young men will know what they want and how to go about getting it. Some of them will have a little start on college work. Many of them will have to start practically as freshmen. But all will be unusually mature regardless of age. Once their readjustment to civilian life has been accomplished they should be good students able to learn rapidly and most promising as future professional talent.

Any college of engineering that is not ready to handle more than its prewar number of undergraduate students in chemical engineering by the fall of 1947, perhaps in 1946, will be sadly out of step with both the need and the opportunity of getting adequate faculties to train these young men. They must get professors who both know their subjects and know how to teach them. It will take approximately 200 new men of professorial grade and more than twice that number as instructors and assistants to rebuild the chemical engineering faculties to a creditable basis.

One of the serious problems which industry must face in this connection is the danger of taking faculty men out of teaching. There will be great temptation in industry to engage professors for research and development work. And the professors will naturally be interested in the more generous immediate financial return that some companies may offer. If there is too much diversion from teaching to industry, there will be even greater delay in the rebuilding of the normal sources of young graduates. And in consequence industry will suffer correspondingly.

TECHNICIAN TRAINING

One engineer assisted by several technicians is able to do much more in research, development, design, or other specialized jobs than the engineer working alone. Often one highly trained individual can spread his talent over the activities of such group and give adequate guidance to several skilled workers. This is particularly true if the assistants are more than mere operative or artisan workers.

Such assistants to be most useful should be truely of technician type. They must have many of the skills of the engineer. They can carry out under general instructions and supervision most of the time-consuming tasks of the engineer. But they do not have the fundamental training and the experience necessary for both the planning of projects and the interpretation of test results. They are dependent on the fully trained professional worker for such judgment and guidance.

To prepare such technicians to aid the engineering profession there has grown up recently a variety of educational agency that is known as the "technical institute." It is very definitely not a trade school, nor one seeking to train artisans. It gives much of the same educational work as fills the lower years part of the full engineering curriculum. But it gives much more training in the laboratory and manipulative methods. The result is a man who knows how to do many things and a reasonable amount of why he does them. Such a man from this training alone does not achieve the creative and planning skill which is supposed to characterize the fully trained professional worker. Many technicians by supplemental study and by experience become really professional workers. This is a matter of temperament and ambition. But so long as they are technicians they are specialized assistants for the professional leader.

TECHNICAL INSTITUTE

Not yet fully recognized, but of great importance, are the schools for this technician training. Some of these are part of the state-supported educational systems. Others are endowed or independent agencies having subsidy from some source. A significant number have grown up under private ownership and are operated very successfully for the profit of their owners.

This group of institutions is now recognized definitely by the engineering profession. Steps are being taken by Engineers Council for Professional Development to aid in accrediting curricula. The hope of the better schools, as well as of E.C.P.D., is that these agencies will adopt and meet high educational standards just as the universities have in their training of engineers. Some of them certainly will reach very high standards because they are adequately financed and are led by very competent educators.

It will not be long before the employment officers of process industries will find it just as necessary to recruit the certificate graduates of these schools as they do now recruit young engineers trained on the college or university campus. Incidentally, it is of interest to note that some of the fine educational programs of industry are leading to the establishment by individual companies of just such schools for the training of their own junior workers. General Motors Corp. and Caterpillar Tractor Co. are two outstanding examples of firms that have done such a job.

REPORTED ENROLLMENTS, EDT-ESMWT III[1-5]
CHEMICAL ENGINEERING AND CHEMISTRY (BY CODES)

	EDT[1]	ESMDT[2]	ESMWT I[3]	ESMWT II[4]	ESMWT III[5]	Total
All Courses	(5,565)	(19,754)	(27,925)	(24,245)	(8,686)	(86,175)
Chemical Engineering	5,565	11,840	13,996	13,323	4,437	49,161
Fundamentals	449	2,554	2,872	1,282	352	7,509
Inspection and testing	1,178	867	589	409	78	3,121
Electrochemical	57	214	141	575	151	1,138
Explosives	2,487	2,973	1,966	311	93	7,830
Petroleum	86	488	1,553	1,567	1,070	4,764
Production	793	1,820	1,869	1,492	314	6,288
Plastics	380	1,666	3,780	6,994	1,922	14,742
Stoichiometry		112	30	109	62	313
Other	135	1,146	1,196	584	395	3,456
Chemistry		7,914	13,929	10,922	4,249	37,014
Fundamentals		2,026	2,534	1,256	594	6,410
Analytical		3,292	7,158	4,441	1,442	16,333
Inorganic		82	130	284	13	509
Organic		1,250	2,055	2,804	1,030	7,139
Physical		590	837	540	242	2,209
Biological		174	336	262	49	821
Other		500	879	1,335	879	3,593

[1]Engineer Defense Training. [2]Engineer, Science and Management Defense Training. [3]Engineer, Science and Management War Training, July 1, 1942—June 30, 1943. [4]Engineer, Science and Management War Training, July 1, 1943—June 30, 1944. [5]Engineer, Science and Management War Training, July 1, 1944—Jan. 31, 1945.

SPECIALIZED WAR TRAINING

During the war period the scarcity of scientists and engineers led to a special Engineer Defense Training under the Office of Education of the federal government. Nearly two million persons have been so registered during the five years of operation of this program. Of these nearly 50,000 were registered in courses classified under some phase of chemical engineering. About 35,000 other registrations were in chemistry. The following tabulation of the five-year total gives an idea of the type of courses that were covered.

Each of these courses has been very brief, ranging from a few weeks to a few months of part-time work. Most of those trained have been actively employed in industry during the training period. But the net result has been the providing of upgrading or specialized review courses that have brought in either technician or specialized professional skills for the benefit of war industry. It is likely that this reserve of trained personnel will be drawn on to great advantage by process industry as it rebuilds its staffs for postwar programs.

Other special training courses have been given by the Army, the Navy, and by firms operating war plants for the government. The result has been the development of a large number of trained technical men skilled either in control or operation of industrial establishments. Many of these can adapt their skills to peace-time projects and take on many of the responsibilities of the chemical engineer if given somewhat greater aid and guidance than the young college-trained engineer might require. These pools of such trainees may, in fact, become the most important source of substitute brain power to take the place quickly which would normally be filled by the young college graduate. They will bring a maturity and a stability to their employment which the man with only college training may lack. Unless they take more courses and continue study during employment, they may find their professional ceiling a bit lower than does the college man. But the reserve of brain power which is there is going to be used by someone. Process industries will want to investigate it carefully.

THE WHOLE PROBLEM

The executives and engineers of process industries must look upon the manpower problem as one of large magnitude and continuing importance. They cannot pass over the training and educational aspects any more than they can ignore the conditions of employment or proper systems of compensation and recognition.

At the present time one of the most serious of these general problems has to do with organization. Union leaders would like to have professional people form unions and affiliate with the suitable federation. Junior and sub-professional workers are in a few cases almost forced to do this. But there is an opportunity and a need for drawing the line between those who must form bargaining units of a union type and those who are properly recognized as the professional employees of enterprise.

Even these professional groups may require some bargaining units for convenient meeting of legal requirements. But the important thing is to maintain among these leaders a professional opportunity and something more than a union trading attitude. The union is right in its place, but there is something incompatible between the routine workers union and the organization of professional workers. They are not in conflict, but they are different and should be kept separate.

In the long run questions of compensation are also going to become a matter of deep concern in the relations between professional workers and industrial enterprise. There are many factors of compensation besides money. Any manpower study must take into account, for example, of the need for professional recognition and the opportunity of cooperation by professional men with their fellows of like interest outside the company in which they are employed. Professional manpower is stimulated to its greatest service and value only when these indirect means of compensation accompany a suitable pay check.

Perhaps no other division of engineering or science has been more fortunate in having friendly and full cooperation and mutual confidence between itself and management than has the profession of chemical engineers. In many cases these engineers are themselves either part of management or dominant in management. As the talents of chemical engineering are made available in a sufficient number of persons having sufficient experience it seems evident that there will be no break in the progress from cub engineer to president or top executive of a technical enterprise. That is as it should be. Anything which lessens the opportunity for such progress is neither good for the profession nor good for technical industry.

What Is Ahead in Labor Relations

VAN T. BOUGHTON

Chairman, Committee on Employment Conditions for Engineers, Engineers' Council for Professional Development

TRENDS in labor matters as they affect engineers are beginning to take a form that is better than was anticipated two or three years ago when the spread of the union movement appeared to be sweeping engineers into organizations in which they would have little or no voice. Today, engineers seem destined to have a considerable amount of independence, both as to whether or not they are to be included in unions, and as to the type of union they go into if they feel the need for collective action.

It does not appear necessary to review here the legal aspects of the position of engineers with respect to collective bargaining as those aspects were set forth in detail by Zola G. Deutsch in *Chem. & Met.* for August, 1944. However, there are a few developments since Deutsch wrote his article that need to be reported to bring the reader up to date.

Under the plan set up by the American Society of Civil Engineers for aiding engineers in the formation of collective-bargaining units to protect their rights, briefly reported by Deutsch, engineers at the Clinton Engineering Works in Tennessee organized the Tennessee Association of Professional Engineering Employees to keep from being absorbed by a unit of the Technical Engineers. Architects and Draftsmen's Union (AFL) that was being organized on that job. The TEADU challenged the right of the TAPEE to speak for the professional engineers, but when matters respecting pay and working conditions for the technical men on the job were brought before a panel of the War Labor Board, the panel heard the TAPEE representatives along with those from the TEADU, and included some of their proposals in its recommendations to the War Labor Board.

The WLB has not yet acted on the report of the panel, but the panel's tacit acceptance of the TAPEE as representative of the professional engineers appears to indicate that it has no doubt as to the legality of units set up under the ASCE plan. This is important because many engineers had feared that the independent unit set up under the sponsorship of a society made up of both employers and employees would not be recognized by the War Labor Board or the National Labor Relations Board.

More recently, William H. Davis, while still chairman of the National War Labor Board, told the Metropolitan Section of the ASCE that he saw no reason why such collective-bargaining units as the TAPEE should not be set up by technical and professional societies to help their members protect their rights. He went on to say that in his opinion engineers would be foolish not to take such action to protect their peculiar rights.

Another event of significance to engineers that has occurred since Deutsch made his survey is a finding by the National Labor Relations Board that the General Motors Corp. had acted illegally when it transferred engineers at its Linden (N. J.)

ant from a salaried classification to the hourly-pay group when those engineers joined the Federation of Architects, Engineers, Chemists and Technicians, and authorized the FAECT to act for them in matters respecting pay and working conditions. The NLRB held that the company's action deprived the men of certain rights and privileges and so was discriminatory. For engineers and other professional men, this means that they cannot be deprived of their peculiar position as professional men should they decide to resort to collective bargaining to improve their economic position.

ECONOMIC SURVEY

A study that may be a factor in helping engineers in employment matters is one relating to the economic status of engineers inaugurated about 18 months ago jointly by the American Society of Mechanical Engineers and the American Institute of Electrical Engineers. These two societies set up a joint committee known as the Committee on the Economic Status of the Engineer to make a study of the professional qualification of their employee members, their compensations, working conditions and employer-employee relations. Subsequently the ASCE asked to be permitted to participate in that study, and the study now is to be further extended under the sponsorship of the Joint Conference Committee, which is a body made up of the secretaries, presidents, and most recent past-presidents of the four founder societies and the American Institute of Chemical Engineers.

The program of the expanded Committee on the Economic Status of the Engineer still is tentative, but it is expected that a questionnaire on compensation and employer-employee relations will be sent to the members of the five societies, and possibly to all engineers in the country, probably with the cooperation of the Bureau of the Census and the Department of Labor. The committee also plans to prepare a manual on labor relations for engineers similar to the manuals prepared by the American Chemical Society, the American Society of Civil Engineers, and the American Association of Engineers. The manual of the latter organization, entitled "Technologist's Stake in the Wagner Act" is the most comprehensive manual yet published.

Briefly stated, the position of engineers, chemists and other professional men today with respect to collective bargaining is about as follows:

Professional men cannot be compelled to join a union in a plant where the employees are being organized if they do not wish to join. This was established in an action brought by the American Chemical Society at the plant of the Shell Development Co. of Emeryville, Calif., where CIO organizers attempted to include the professional workers in an organization made up of professional and non-professional men. As yet, there has been no decision that would establish the position of professional men employed by a company which had entered into a closed shop agreement with respect to its production employees. However, the Shell Development decision would appear to indicate that they could successfully resist inclusion in a vertical union of this kind.

When the employees of any company are being organized, the professional men can set up an organization of their own if they wish to be separately represented in collective bargaining, provided they act promptly enough. This conclusion has not been definitely established, but it is substantiated by what the War Labor Board panel said that ruled against the collective-bargaining unit sponsored by the ASCE at the Sunflower Ordnance Works when it turned down that group's request for separate recognition. The panel said that it probably would have recognized the professional men as a separate unit had they sought separate recognition promptly when the Technical Engineers, Architects and Draftsmen's Unions started organizing the professional and sub-professional men on the job.

Finally, if engineers want collective bargaining and prefer to be represented by a large union rather than an independent unit, they can join such a union without risk of being deprived of rights and privileges that they held in their unorganized status. As previously noted, this was decided recently at the Linden plant of the General Motors Corp.

In connection with the apparent trend of labor boards and labor panels to recognize the peculiar status of professional men with respect to collective bargaining matters, it is of interest to note that the Federation of Architects, Engineers, Chemists and Technicians (CIO) has begun to lay the groundwork for an internal reorganization that will give professional men within that union the independence from sub-professional men that many professional men appear to want. This should make it easier for professional men to affiliate with that organization. As yet little is known concerning the plan, but it is believed to call for an autonomous organization of men in the professional grade within the FAECT structure.

It does not now appear probable that many professional men will set up independent collective-bargaining units such as those proposed by the ASCE. Units of that kind, speaking generally, will only be set up as defensive measures. In isolated instances, where employers are exploiting their professional employees, some such units may be created by employees who are averse to joining the normal type of union.

Also, because of the fact that most of the existing unions resort to strikes and other practices that are not popular with professional men, it does not appear probable that many engineers will join either of the large unions that now seek to enlist their interest. On the other hand, it is possible that unions with high standards and without affiliations that might involve them in sympathetic strikes, may ultimately gain a fairly large membership among professional men, especially those employed by large industrial corporations in which most of the other employees are unionized. Two organizations with this objective already are in the field. One is the Association of Industrial Scientists, organized by the professional workers at the Shell Development Co.'s plant at Emeryville, Calif., after they won their independence, and the other is the Engineers & Architects Association. The latter, under the name of the Engineers & Architects Association of Southern California, has been in existence for 50 years. Recently it expanded to provide engineers employed in the airplane industries of Southern California with a collective bargaining organization independent of existing unions. Now it has undertaken to provide the nucleus of a new national organization of engineers and other professional men for collective action.

IT IS UP TO THE MEN

The important fact to be recognized is that if engineers and other professional men need collective bargaining organizations in the future, they must seek help from organizations such as these or from established trade unions, not from the professional and technical societies. Actions taken by the American Chemical Society and the American Society of Civil Engineers were taken as emergency measures to establish the independence of professional men from domination by unions in which they could have but little voice. Each stepped in because there was no organization better fitted or able to act at the moment, but neither organization can or should be expected to act as a collective bargaining agency.

From now on it is up to the men themselves. It will cost those who want collective bargaining less if they throw their lot in with one of the existing unions such as the TEADU or the FAECT, but if they want to act independently, free of actions that have made unions unpopular with professional men, they can set up their own collective bargaining units.

Reprints of this report are available at 25 cents per copy. Address the Editorial Department, *Chem. & Met.*, 330 West 42nd St., New York 18, N.Y.

CHEM. & MET. PLANT NOTEBOOK

THEODORE R. OLIVE, Associate Editor

$50 WAR BOND FOR A GOOD IDEA!

Until further notice the editors of *Chem. & Met.* will award a $50 Series E War Bond each month to the author of the best short article received during the *preceding* month and accepted for publication in the "*Chem. & Met.* Plant Notebook." Articles will be judged during the month following receipt, and the award announced in the issue of that month. The judges will be the editors of *Chem. & Met.* Non-winning articles submitted for this contest may be published if acceptable, and if published will be paid for at space rates applying to this department.

Any reader of *Chem. & Met.*, other than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 300 words, but illustrated if possible. Neither finished drawings nor polished writing are necessary, since only appropriateness, novelty and usefulness of the ideas presented are criteria of the judging.

Articles may deal with any sort of plant or production "kink" or shortcut that will be of interest to chemical engineers in the process industries. In addition, novel means of presenting useful data, as well as new cost-cutting ideas, are acceptable. Address entries to Plant Notebook Editor, *Chem. & Met.*, 330 West 42nd St., New York 18, N. Y.

MARCH WINNER!

A $50 Series E War Bond will be issued in the name of

NEO S. SERINIS

Senior Project Engineer
Owens-Illinois Glass Co.
Berlin, N. J.

For an article dealing with a readily constructed and simple type of comparative viscometer which has been adjudged the winner of our March contest.

This article will appear in our May issue. Watch for it!

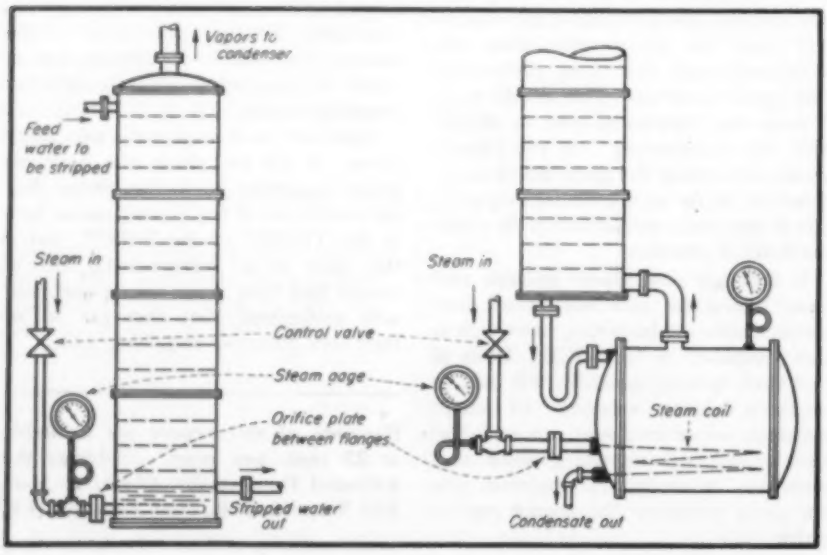
February Contest Prize Winner

USING AN ORIFICE TO ASSIST CONTROL OF LOW PRESSURE STEAM FLOW

DONALD F. OTHMER
Polytechnic Institute of Brooklyn
Brooklyn, N. Y.

IN THE OPERATION of a distillation column for stripping water which is discharged from the base, with live steam blown directly in to contact the water below the lowest plate, the exhaust pressure of the stream is atmospheric or only very slightly above. This is also true in various other operations, such as in the regulation of experimental distillation equipment, where the heating surface may be very much too large in relation to the amount of heat to be transferred for some particular purpose, or where a low-boiling solvent is being used to give a larger temperature difference than that for which the unit was designed. This often results in leaving the discharge end of the heating coil open to the atmosphere; and no reading on the steam gage may be made to serve to control the rate of heat supply. Other cases also occur where the steam pressure shown on the gage does not increase enough to serve to control the operation even with a very substantial increase in rate of flow of steam; and hence a very substantial change (several hundred percent or more) in the operating conditions of the unit.

In applications such as these where the back pressure in the steam system is small, an orifice to build up back pressure on the gage permits good manual flow control by multiplying the gage readings



A very simple device which, however, appears to be known to few people, has been used for several years in the control of such equipment. It depends on the insertion of a simple orifice plate just in front of the inlet of steam into the equipment. This plate has an orifice hole drilled to a size depending on the amount of steam it is desired to pass at the maximum desired rate and with the maximum steam pressure available. Formulas are available in various handbooks for calculating the size of this hole. (See also *Chem. & Met.*, Mar. 1945, p. 117.) It may also be estimated simply. If the hole is too small it may be enlarged; or if it is too large another steel plate may be quickly made. In this utilization, the orifice plate and the gage between it and the valve act as a simple orifice flow meter, since the discharge side of the orifice is at a comparatively constant pressure, around atmospheric.

For example, in a water stripping column with live steam supply, the pressure through the column and hence that normally in the base of the still, is due principally to the liquid seal on the plates and is very little affected by the rate of steam supplied to the base. By the use of the

rifice plate, the steam gage may read ver the whole range from the normal ressure of the discharge side almost up o the normal pressure of the steam line tself.

In an actual case, where the pressure n the column—and hence that shown n the steam gage in the steam supply ine—varied from 1.5 lb. per sq. in. ga. t practically zero throughput, to 2 lb. at 00 percent of rated throughput, this light pressure change was imperceptible on an ordinary steam gage. The steam ine pressure was 80 lb.; and by installaion of an orifice plate between the anges connecting the steam line to the ase of the column, the readings of the ame pressure gage ranged from 5 lb. er sq. in. ga. to 60 lb. Control of the peration was thus made possible at any esired percent of rated capacity simply y observing the regular gage, because f the multiplication of its reading.

For control of small equipment where standard union connects the steam line o the still, with the pressure gage and ontrol valve upstream, it is often possible o place a sheet metal disk having a drilled or punched orifice between the oining faces and still close the union ightly. Rapid erosion of the thin orifice ay be prevented by building up a greater hickness in the center before drilling the rifice. A "nickel" 5-cent coin may be razed to the center of a thin disk for a -in. or larger union; or the end of a pipe ipple may have such an orifice disk razed on as a cap and drilled before crewing it into a standard fitting.

FOOLPROOF LUBRICATION FOR PLANT MACHINES

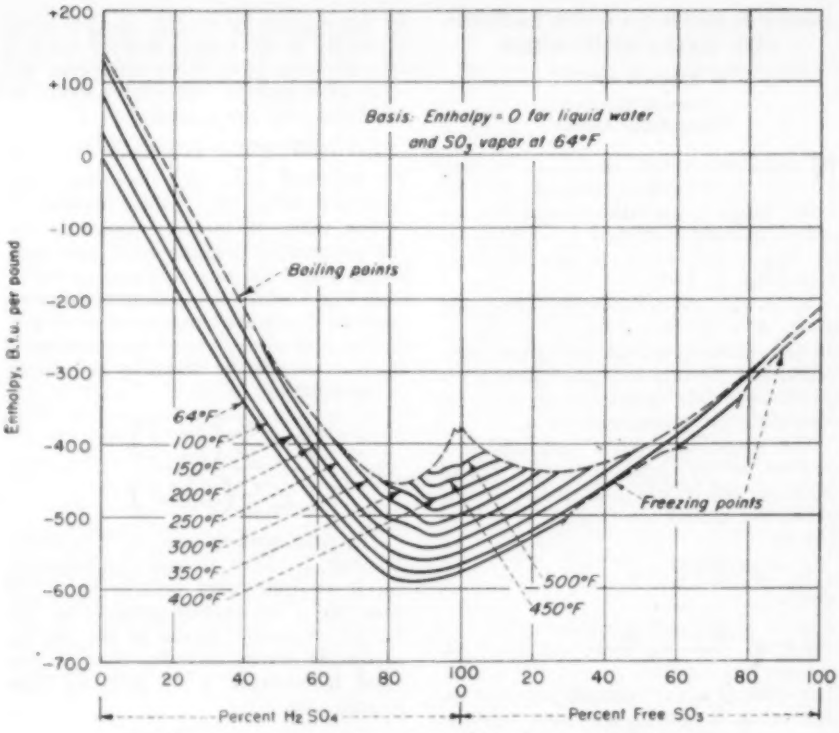
P. de CHAZAL
Aluminum Co. of Canada, Ltd.
Arvida, P. Q., Canada

When construction on one of our plants was approaching conclusion, thought had to be given to the organization of maintainance of the equipment, particularly with regard to lubrication and inspection.

A survey of the equipment was made by a lubrication engineer of the oil company which supplied our lubricants. On analyzing his recommendations, it was found that six greases would take care of all the equipment. Of these, one was to be used only under special conditions.

The machinery we received was equipped with three different types of grease fittings and we realized that it would be fairly simple to arrange the distribution of these fittings so as to enable each of the three main greases to be applied through one, and only one of the three types of fittings. The two other greases recommended were used only on one piece of equipment each and it was fairly easy to insure against the use of the wrong grease in these cases.

We proceeded to make up a number of metallic tags specifying the type of grease and frequency of greasing. These tags were applied to each piece of equipment at the location of the fitting. The fittings were interchanged to permit this plan to be put into execution. The final result was that special grease guns were used with only one type of grease and could only grease that type of equipment which required the grease in the gun. By this very inexpensive change and method of control we believe that we have been able to establish a lubricating procedure which is practically foolproof. The results, after about one year of operation, have proved very satisfactory and it is planned to put this idea into effect in other sections of the plant. We also believe that this system can be used to good advantage in a great many other industrial organizations where the types of grease and uses are restricted to a small number.



Enthalpy-concentration chart for sulphuric acid and oleum

LOG-LOG RULE CALCULATES LOGARITHMIC MEAN

D. S. DAVIS
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In a recent article M. T. Sanders (*Chem. & Met.*, Dec. 1944, p. 116) described a method of calculating the logarithmic mean, C_m, of two numbers, C_1 and C_2, in accordance with the formula given below:

$$C_m = \frac{C_1 - C_2}{\ln C_1/C_2}$$

His method employs only the *C* and *D* scales of an ordinary slide rule but requires a table of values of $(a-1)/\ln a$ where $a = C_1/C_2$.

It may be well at this time to call attention to another method of computing logarithmic means as reported by T. N. Dalton (*Ind. Eng. Chem.*, 30, 1938, p. 1081). This method is limited to the log-log slide rule but requires no table of values of any function. It consists of setting the difference, C_1—C_2, on the *C*-scale opposite C_1/C_2 on the proper *LL*-scale and reading C_m on the *C*-scale over e on the *LL*-scale. Thus to find the logarithmic mean of 150 and 50, set 150—50 or 100 on the *C*-scale opposite 150/50 or 3 on the *LL*-scale and over e on the *LL*-scale read the logarithmic mean on the *C*-scale as 91.1.

SULPHURIC ACID AND OLEUM ENTHALPY CHART

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Finding heats of mixing and dilution of sulphuric acid and oleum is readily accomplished with the accompanying enthalpy-concentration chart, which is also of value for estimating the cooling requirements in sulphuric acid absorbers. In spite of the utility of the chart, the writer has not previously found this information in such convenient form in the literature. Sources of the data employed in the plotting are indicated in the accompanying tabulation of data sources.

DATA SOURCES

1. Bichowski and Rossini, "Thermochemistry of Chemical Substances," 1st ed., Reinhold Pub. Corp., New York, 1936. Heats of dilution of sulphuric acid solutions.
2. Hermann, *Ind. Eng. Chem.*, 33, 898 (1941). Correlation of all available data on heats of dilution of oleums.
3. Socolik, *Z phys. Chem.*, 158, 305-12 (1932). Specific heat of sulphuric acid solutions.
4. Knietsch, *Ber.*, 34, 4069-4115 (1901). Specific heat of oleums.
5. Rogers, "Manual of Industrial Chemistry," 6th ed., D. Van Nostrand Co., Inc., New York, 1942. Freezing points of sulphuric acid and oleums.
6. Unpublished notes on industrial chemistry, Dept. of Chem. Eng., M.I.T., 1944. Boiling points of sulphuric acid and oleums.

ORIFICE DESIGN COMPUTATIONS FOR GASES SIMPLIFIED

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NUMEROUS requests have been received for a simplified method for gas orifice design computations, similar to the system recently published by the author for liquids and steam (*Chem. & Met.*, May 1944, p. 140).

As in the reference article mentioned above, K is plotted vs. d/D in Fig. 1, thereby eliminating trial and error calculations and the fourth degree equation encountered in the customary method for computing the proper orifice size.

The simplified method presented here involves merely substituting the known factors in the following equations, solving for K, and reading the value of d/D from Fig. 1:

$$K = QG/D^2BM \qquad (1)$$

where

$$G = \sqrt{\frac{(459.6 + t)\text{Sp. G.}}{hP}} \qquad (2)$$

The value Q is the volumetric rate of gas flow in cu. ft. per hr. and since gases are compressible the conditions of temperature and pressure must be stated. Fig. 1 is based upon a gas flow at 60 deg. F. and 30 in. Hg absolute pressure. B, the temperature-pressure correction factor,* is dependent upon Q and is used to correct for temperatures and pressures other than 60 deg. F. and 30 in. Hg. If Q is given or desired at 60 deg. F. and 30 in. Hg, then $B = 1$. For other conditions the value of B may be found from Fig. 2 or calculated from the equation:

$$B = 0.0577\,(459.6 + t)/P \qquad (3)$$

For saturated gases P_w, the water-vapor pressure in inches Hg, is subtracted from P.

The value M involves correction for the presence of moisture that may exist in the gas.* Values for M may be found from Fig. 3 which is based upon the most common dew point temperature of 60 deg. F. For any other desired temperatures a similar chart can be drawn by calculating in the equation

$$M = \frac{\sqrt{1 + \frac{P_w}{P}\left(\frac{S_w - 1}{\text{Sp. G.}}\right)}}{1 + \frac{S_w}{\text{Sp.G.}}\left(\frac{P_w}{P - P_w}\right)} \qquad (4)$$

The other symbols used are: d = orifice diameter, in.; D = internal pipe diameter, in.; h = differential pressure, in. H_2O under air; P = absolute pressure, in. Hg; Sp. G. = specific gravity of the gas; S_w = specific gravity of water vapor at dew point temperature; t = operating temperature, deg. F.

Use of the simplified method is illustrated in the following example:

The maximum flow of a gas (Sp. G. = 0.4) saturated with water vapor (dew point temp. = 60 deg. F.) through a 6.06-in. i. d. pipe is estimated to be 100,000 cu. ft. per hr. at operating conditions of 50 in. Hg absolute pressure and 120 deg. F. What should be the diameter of the orifice hole to obtain a 30-in. H_2O manometer differential pressure? Flange taps are to be used.

By Equation (2),

$$G = \sqrt{\frac{(459.6 + 120)\,0.4}{30 \times 50}} = 0.393.$$

From Fig. 2 B for 120 deg. F. and 50 − 0.5 or 49.5 in. Hg = 0.68.

From Fig. 3, at Sp. G. = 0.4 and 50 in. Hg. $M = 0.987$.

$D^2 = 36.72$.

Then by Equation (1), $K = QG/D^2BM = 100{,}000 \times 0.393 \div (36.72 \times 0.68 \times 0.987) = 1{,}595$.

From Fig. 1 for K equal to 1.595 we find $d/D = 0.66$. Therefore, $d = 0.66 \times 6.06 = 4.0$ in. The diameter of the orifice should be 4.0 in.

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* Rhodes, "Industrial Instruments for Measurement and Control," McGraw-Hill Book Co., Inc., New York (1941).

Fig. 2—Chart for temperature-pressure correction

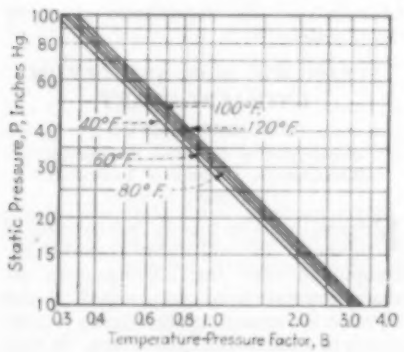


Fig. 3—Chart for correcting for moisture content of gas

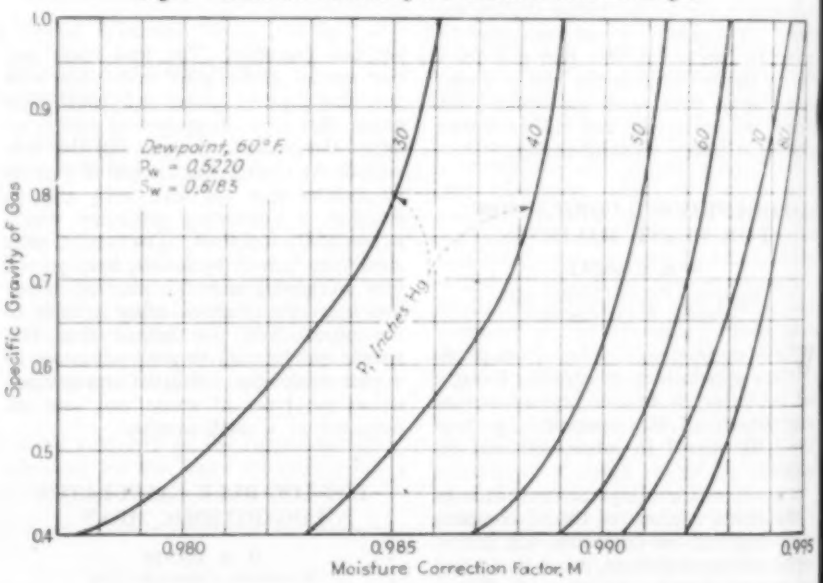
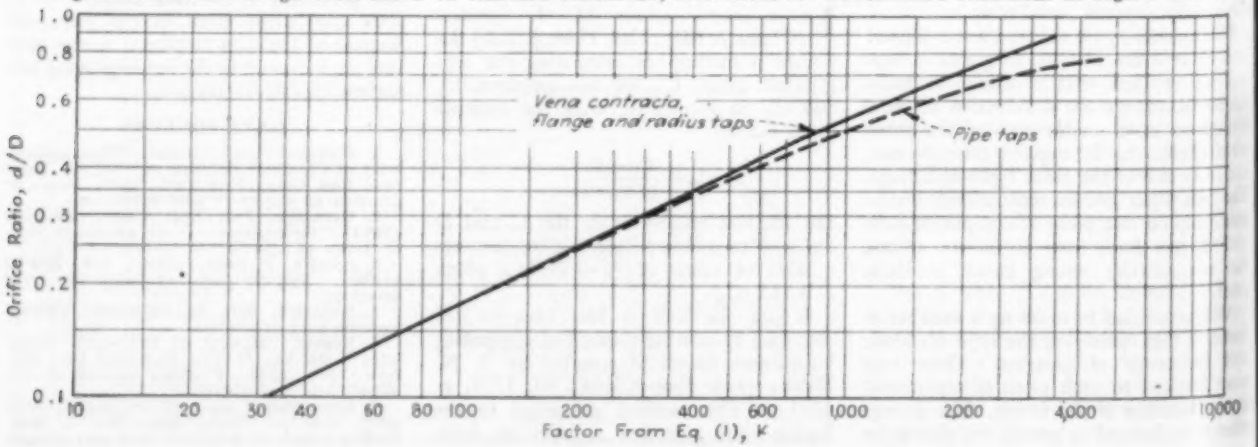


Fig. 1—Gas orifice design chart based on standard conditions; corrections for non-standard conditions in Figs. 2 and 3



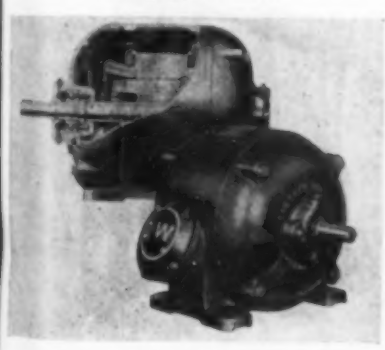
PROCESS EQUIPMENT NEWS

THEODORE R. OLIVE, Associate Editor

PROTECTED MOTOR

COMBINING the surplus capacity of the conventional open motor with protection against dripping liquids and other foreign matter has been accomplished in a new protected type motor announced by the Crocker-Wheeler Division of Joshua Hendy Iron Works, Ampere, N. J. Use of shielded construction of the ventilating openings, plus an absence of openings in the frame or shield above the horizontal centerline, is said to make the motor proof against ordinary hazards. Motors are rated for 40 deg. C. temperature rise and are available in sizes up to and including the No. 284 frame. Aluminum alloy rotors cast in one operation, heavy cast frame construction and vinyl acetal insulation are other features.

New protected motor



FINE PULVERIZER

FOR THE production of ultra-fine powders in the range from 1 to 25 microns, Pulverizing Machinery Co., Summit, N. J., has developed a new mechanical, screenless pulverizer which has been given the name of Mikro-Atomizer. Whereas the output of this concern's other fine grinding equipment is measured in terms of the 325 mesh screen, the new machine is being offered to grind to particle sizes as low as 1 to 2 microns on certain materials. The small machine now being offered, which requires 10-20 hp., will produce, for example, 30 lb. of titanium dioxide per horsepower-hour, ground to 5 microns or finer; or 20 lb. of nickel carbonate per horsepower-hour, ground to 10 microns or finer.

The machine consists of four kinds of essential parts, including a rotor with a special form of impact members; a pair of dispersion rings, for instantaneously dispersing powdered particles with air as they leave the impact members; two separator wheels which reject all large particles back into the path of the rotor through the opposing forces of centrifugal action and aerodynamic drag, and which also discharge finished particles from the mill; and two fans in volute casings which draw the necessary air into the mill and discharge the finished product into a conventional collector. The mill is of duplex construction, having on each side of a single, centrally located rotor one separator, one dispersion ring and one fan, all assembled with a single drive shaft and a composite housing.

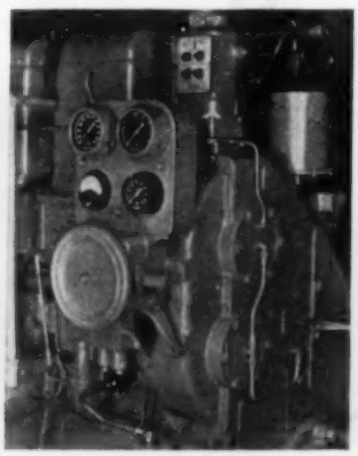
Material is fed to the rotor at the middle of the periphery, there dividing into two streams which are ground on the two sides of the rotor. Material leaving the rotor is either passed or returned to the rotor by the separator wheels. Adequately pulverized material is removed by the air stream, passing through the fans to special cyclone product collectors. The small mill now available weighs 1,300 lb. and requires 17 sq.ft. of floor space. Another mill having a capacity about four times greater is now in process of development.

Installation of Mikro-Atomizer

INTERCHANGEABLE DIESEL

ALTHOUGH the idea of constructing diesel engines capable of operating either on gas or on oil fuel is not new, it is claimed by the Cooper-Bessemer Corp., Mt. Vernon, Ohio, that previous diesel engines embodying interchangeability required quite extensive changes in going from one fuel to the other. A new development of this company now makes it possible to build engines operating on the diesel cycle in which the engine can be changed from oil to gas, or vice versa, merely by closing one valve and opening another, with the engine operating continuously at full load.

Control end of 675-hp. gas-oil diesel



As compared with the ordinary spark-ignition cycle, it is claimed that savings in fuel consumption of 20 to 25 percent can be secured in operating on gas by employing the diesel cycle. The unit operates on fuel oil, sewage plant gas, refinery by-product gases, natural or manufactured gas or coke oven gas, equally well.

In the past it has been thought necessary to inject gas into a compression-combustion engine under a high pressure of from 1,200 to 1,500 lb. It was thought that allowing the gas to enter with the intake air would cause pre-ignition. However, it was not realized that with the efficiency of a diesel cycle, the ratio of gas to air would be lower than with the Otto cycle engine. Therefore, the mixture used could be extremely lean and not easily ignited. It was found possible to admit the gas with the engine's air intake and still avoid pre-ignition, provided, however, that a pilot oil injection was also used. Using this practice, assuming the engine is operating on oil and it is desired to change to gas, if gas is admitted in the intake air the governor will immediately reduce the amount of oil to compensate for the percentage of load being carried by the gas. It is then merely necessary to reduce the fuel oil injection to the desired minimum for ignition, and govern the percentage of gas according to the load. In other words, the fuel oil system is set in a minimum position and the governor reconnected to the gas regulating valve.

Simplified controls for accomplishing this purpose are available, and it is possible, in fact, to cause the engine automatically to shift from one fuel to the other as gas availability fluctuates.

SELF-CONTAINED OVEN

DRYING OPERATIONS which involve the evaporation of large quantities of highly volatile solvents can be handled, according to the manufacturer, in a new standard box-type oven that has been announced by Industrial Oven Engineering Co., 11621 Detroit Ave., Cleveland, Ohio. The oven is self-contained, with all heating equipment and duct work built into the oven shell. It is either shipped assembled, ready to operate, or shipped in prefabricated sec-

tions for quick assembly. Ovens operate in the temperature range from 150 to 900 deg. F., with a control tolerance of plus or minus 2 deg. F. Despite the fact that this equipment is direct gas fired, which would seem to present a hazard in evaporating large quantities of flammable and explosive materials, it has proven safe according to the maker, and has insurance company approval.

Typical applications include the removal of such solvents as alcohol, acetone, naphtha and methyl-ethyl ketone, from a variety of solid products. The unit is said to be especially suited to dense loads where air-stream resistance is high. A variety of types of automatic control are available, depending on users' requirements.

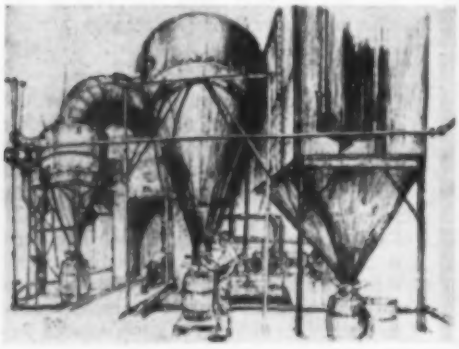
IMPROVED SLIDE RULE

To ENABLE slide rules to be employed by persons with little mathematical background, and particularly to facilitate location of the decimal point in calculations involving a considerable number of digits or zeros, Pickett & Eckel, 53 West Jackson Blvd., Chicago 4, Ill., has introduced the new Deci.Point decimal point locator and slide rule. The decimal point locator, which occupies the reverse side of a modified Mannheim rule, is a mechanical method for decimal point location insuring accuracy with expressions involving up to 19 digits or zeros in the result. Another novel feature is the use of the complete length of the rule for each of three sections of the cube root scale and for the two sections of the square root scale, permitting 30-in. slide rule accutacy in cube root work and 20-in. slide rule accuracy in square root work, with a 10-in. rule. In addition to the root scales, the rule contains log, sine, tangent and C and D scales.

ATTRITION GRINDER

GRINDING merely by passing the material to be ground in air suspension through a long pipe is the feature of the Eagle Mill introduced by International Ore Corp., 500 Fifth Ave., New York 18, N. Y. This principal, developed for its own use by the Eagle Pencil Co. of New York, is said to make possible grinding to micron sizes of many materials without impact or shattering action and without generation of heat. The grinding action is produced by a gentle flow of particles carried by air through an extremely long pipe, the inlet of which is under pressure and the outlet under suction. Material is gradually fed into the pipe in accordance with the desired output. The pipe column is said to move at a comparatively low rate of speed, caused by frictional retardation. In the grinding of graphite, for example, the particles have a rate of movement of about 8 to 10 ft. per sec. in a pipe about 200 ft. long and 2 in. in diameter. The pipe is close-circuited with separation equipment for removing the product when reduced to the desired size. Strangely enough, it is claimed that there is practically no wear in the mill, with the exception of a single nozzle, said to last for many months when made from certain hard alloys. The mill is claimed to have operated successfully on a wide range of minerals and cereals as well as on certain difficult-to-grind chemicals such as iron blue. Inert gas may be used instead of air for conveying, if desired.

New Eagle grinding mill; the greater part of the grinding pipe is out of the view at the right



NEW AUGER PACKER

AN IMPROVEMENT in auger packers for filling and packing powdered materials has been announced by the Triangle Packaging Machinery Co., 906 North Spaulding Ave., Chicago, Ill. The machine is suitable for handling quantities from several ounces up to 5 lb. and is capable of handling 30 or more 1-lb. packages per minute. It utilizes automatic feeding of the material instead of foot lever control, thus increasing production by 10-25 percent over previous models. This feature is also stated to reduce operator fatigue considerably. The packer is equipped with an electrically controlled emergency stop switch, enabling the operator to cut off the feed of material instantly if anything goes wrong. Appearance, safety and protection from dust are enhanced by the streamlined inclosure employed.

CROSS-FLOW CLASSIFIER

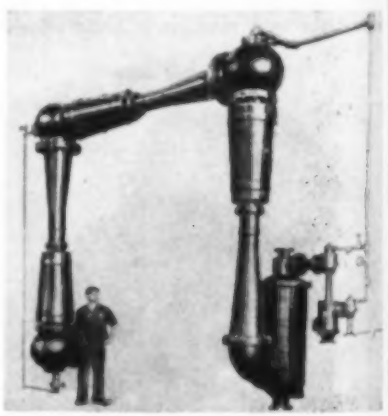
A NOVEL variation in design of classifiers of the type employing a spiral conveying element in a sloping trough is the new cross-flow classifier developed by Denver Equipment Co., 1400 17th St., Denver 17, Colo. In this design the overflow weir is on the side of the trough opposite the feed, rather than at the end of the classifier. Thus the classifier conveyor flights are in line with the direction of the pulp flow, permitting an uninterrupted smooth flow of pulp across the classifier from feed entrance to overflow weir. The design permits the elimination of the submerged bearing at the lower end of the conveyor spiral, as ordinarily employed, with the lower bearing now placed somewhat below the middle of the shaft, but above the maximum pulp level.

In all classifiers some eddy currents are unavoidable, causing some of the fine particles to be carried to the bottom while some of the coarse particles may be carried to the surface, thus overflowing with the fines. The new design minimizes agitation causing eddy currents and, at the same time, by reason of the fact that the conveyor rotates above the surface in the same direction as the pulp flow, causes the course material to move away from the overflow weir so as to assist separation of the sands and the fines. The slowly revolving helical conveyor is said to give

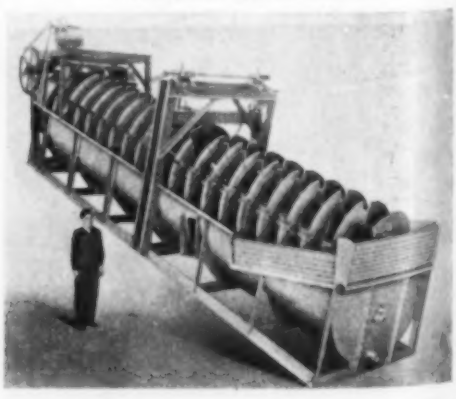
Auger packer for powders

Five-Stage Steam Ejector

The five-stage steam ejector shown here, manufactured by the Elliott Co., Jeannette, Pa., is one of eight installations for the Electro Metallurgical Co. These have a much greater capacity at 100 microns Hg pressure than any other single piece of vacuum producing equipment of any kind ever built before, according to the maker. At this pressure the unit handles 6 lb. per hr. of air rated at atmospheric pressure and 70 deg. F. To handle the same load a mechanical vacuum pump operating at a volumetric efficiency of 65 percent at the same pressure would require a displacement of 15,600 c.f.m. A diffusion pump operating at the same pressure would have a speed of 4,800 liters per sec. and would require a mechanical backing-up pump with a displacement of approximately 550 c.f.m.



60-in. cross-flow classifier



just enough agitation to the settled solids to allow the release of fine material to the surface stream, without danger of carrying large material into the overflow.

The unit is available in 11 single-spiral sizes from 6 to 60 in. and in seven models employing duplex spirals, from 24 to 60 in. Heavier models, 30 in. and larger, are provided with a lifting device whereby the lower end of the conveyer may be lifted free of settled solids in case of a shutdown. Classifiers of this type are recommended by the manufacturer for closed circuit grinding, sand-slime separations, dewatering and continuous countercurrent washing.

PERMANENT MAGNET SEPARATOR

AN EXTREMELY high separating force on ferrous materials is featured in the Eriez permanent magnet separator developed by the Eriez Mfg. Co., Erie, Pa. The basic unit of this separator is an Alnico magnet of exceptionally large size. As many of these magnets as may be necessary to give the desired pole face area are mounted together as a unit which may then be installed rigidly or in a hinged mounting in spouts, chutes, hoppers or on feed tables. The several magnets are attached to continuous metal pole faces. The entire unit is then insulated with brass or copper from the surrounding metal equipment to which it may be attached to prevent the equipment from absorbing the magnets' strength. Special types are also available for removing magnetic particles suspended in liquid.

FINE GRINDING MILL

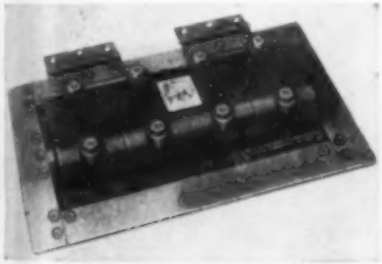
WHAT appears to be a new principal in the construction of grinding equipment is found in the De Anza mill which has been introduced by Coastal Engineering Ltd., 582 Market St., San Francisco 4, Calif. The mill, which is the invention of mining engineer George F. Ainza, operates entirely by attrition of the material being ground against itself, without the use of auxiliary beating or crushing elements. As is shown in the accompanying illustration, the mill consists essentially of a rotating bowl mounted on a horizontal axis which is revolved at a speed from 1,200 to 2,000 r.p.m., depending on the size of mill. The speed is chosen to secure an attrition velocity of about 300 ft. per second. In addition to the rotating bowl there is a slowly rotating drum, turning at 6 r.p.m. or faster, depending on the fineness of grind desired, which acts as a material elevator and recirculator, holding material in the grinding circuit until particles are fine enough to leave the mill by way of either a wet or a dry classifier. To carry out this function, the drum is equipped with lifters around the periphery and is carried on circumferential tires and rolls in the manner of a rotary kiln.

Material elevated by the lifters is chuted into the rapidly rotating bowl. Centrifugal force holds a layer of material within the bowl and it is the action of material falling upon this rapidly spinning layer which accomplishes the grinding. The only wearing part of the mill is the retaining ring at the mouth of the bowl and it is claimed that only nominal wear takes place on this readily replaceable part. Actually, according to the manufacturer, there is so little wear that metallic contamination of the material ground cannot be detected.

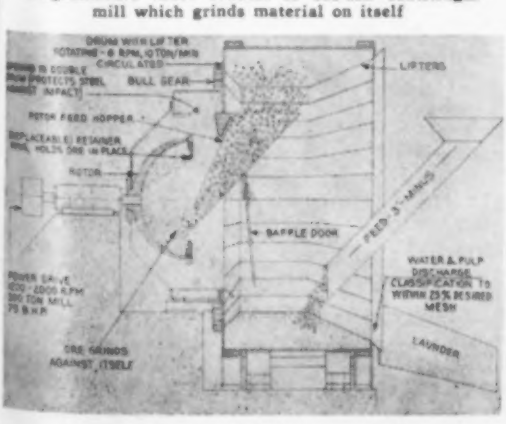
The mill is said already to have found application on a variety of materials ranging from extremely hard to soft, and to have shown large decreases in grinding costs as compared with other methods. For example, in grinding one material from lump in excess of 3 in. size to 60 percent through 200 mesh, the overall power consumption was found to be 16.8 kw.-hr. per ton employing a crusher and ball mill, compared with 5.5 kw.-hr. per ton employing a crusher and DeAnza mill. In this test the ball mill showed a wear on a medium hard ore of 2.0 lb. of metal per ton of ore, compared with 0.0125 lb. of metal per ton of ore for the DeAnza mill.

The DeAnza mill, named after an ancestor of the inventor well known in the early history of California and Mexico, is now available in sizes from 5 to 500 tons per day, to concerns with suitable priorities. It is recommended by the manufacturer for the grinding of pigments, limestone, cement raw materials and a variety of metallic and non-metallic minerals, covering practically the entire field of fine grinding. The mill is sold without accessories so that the motor or engine, classifying and dust collecting equipment must be provided by the user.

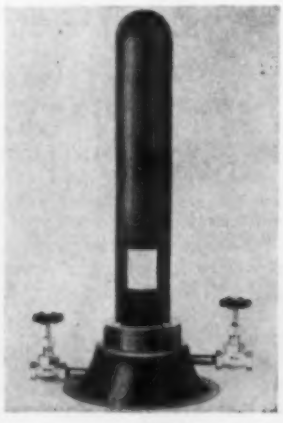
Permanent magnet separator



Diagrammatic cross section of 300-ton centrifugal mill which grinds material on itself



Deoxo gas purifier



EXPLOSION-PROOF MOTOR

RATED for Underwriters Class 1, Grades C and D hazardous locations, a new explosion-proof motor for use with automatic controls has been announced by the Warren Telechron Co., Ashland, Mass. The new motor is totally inclosed in a bronze casting with a removable screwed cover and is adapted for explosion-proof conduit mounting. It can be supplied in various shaft speeds, voltages and frequencies. Suitable for use in atmospheres containing such vapors as gasoline, ethyl ether, alcohol and acetone, the motor has already been employed in a number of large war plants producing chemicals, synthetic rubber, aviation fuel and ammunition.

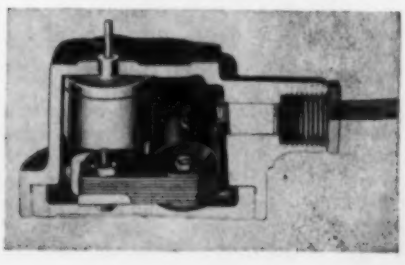
OXYGEN REMOVER

PALLADIUM metal, precious but unrestricted, is used as a catalyst in a newly developed gas purifier announced by Baker & Co., Inc., Newark, N. J. The new unit, known as the Deoxo gas purifier, is being offered in two sizes, 200 cu.ft. of gas per hr., and 1,000 cu.ft. of gas per hr., for the removal of oxygen from such gases as hydrogen, nitrogen, argon and neon. The unit operates at room temperature and is said to reduce the oxygen content of gases treated to less than 20 parts per million. Previous methods employed have required operation at elevated temperatures, with careful control. Thus the new method eliminates warming up and cooling down times before and after use, requires no maintenance and, according to indications, will last indefinitely. A new portable analyzer, now being perfected as an adjunct to the purifier, will indicate continuously the quantity of oxygen present in the gas.

EQUIPMENT BRIEFS

SEVERAL years ago the Marco Co., 511 Monroe St., Wilmington 17, Del., developed a special type of positive displacement gear pump for use with the homogenizers which it manufactures. The company has now decided to place these pumps on the market separately. Several features are stressed. The pump is capable of maintaining a steady, non-pulsating delivery without churning or foaming and

Explosion-proof control motor



its design permits ready cleaning in cases where a change from one product to another is necessary. It is suitable, according to the manufacturer, for any pumpable material, either light or heavy. An important feature is an automatic "wear control" which is said to guarantee the efficiency of the pump during its normal wear. Tapered roller bearings run in oil, automatic seals, and stainless metal construction are other features.

A NEW DESIGN of lock nut known as the Flexloc, formerly available only for army ordnance and aircraft purposes, is now available to the general industrial market from Standard Pressed Steel Co., Jenkintown, Pa. This nut is a one-piece unit containing six radical slots in a flexible portion, providing an equal number of threaded sections of flexible character which do the actual locking. Since the locking torque is adjustable in manufacture, it is claimed that the locking action is smooth yet firm, resisting unintentional loosening, but allowing the nut to be used on studs without the necessity for backing out the stud when the nut is removed. Many sizes up to 1 in. are available.

KANO LABORATORIES, 75 East Wacker Drive, Chicago 1, Ill., has announced Kano Kroil, a creeping, penetrating chemical of extremely low surface tension, suitable for finding leaks in welded joints. The material is sprayed as a thin film along the seams and it is claimed that even the most minute openings are quickly penetrated to the opposite side of the seam without need for forcing the liquid through the opening by pressure.

AN IMPROVED automatic drum and barrel filler known as the Penflex, said to give 40 percent faster flow, is being manufactured by Pennsylvania Flexible Metallic Tubing Co., 7203 Powers Lane, Philadelphia 42, Pa. Designed to handle both heavy and light oils, hot or cold, under pressure or gravity, as well as volatile materials, the device is reported easy to adjust for viscosity and desired level. The unit is automatic in action, the flow stopping without loss from overflow when the desired level is reached, so that a single attendant can handle several units.

A NEW explosion-proof motor for operation in ethyl ether vapors (Underwriters' Class I, Group C) has been announced by Century Electric Co., 1806 Pine St., St. Louis 3, Mo. The motor, constructed to meet the specification of Underwriters' Laboratories for this type of hazard, is an addition to the company's other explosion-proof motors for other hazardous locations, including those operating in gasoline vapor, metallic dusts, carbon black and grain dust.

A NEW MODEL of the chlorine dioxide generator, developed and announced a few months ago by the Mathieson Alkali Works, 60 East 42nd St., New York 17, N. Y., has recently been announced by this concern. Employing chlorine gas and dry sodium chlorite, the new model contains the chlorite in a reaction tower within the control unit, in contrast with earlier models which required separate chorite towers. Removable front and side panels make all parts of the unit easily accessible for servicing. The new generator measures 5 ft. in height, 2 ft. in width and 18 in. in depth. Chlorine dioxide, having 2½ times the oxidizing power of chlorine, is now being used commercially in a variety of dry bleaching applications and is being used in solution for bleaching soap, paper and textiles and for removing objectionable tastes as well as odors from public water supplies.

FOR THE dielectric heating of plastic preforms for small molding operations, the Girdler Corp., Louisville, Ky., has introduced a new small 400-watt high-frequency heating unit, known as Model X875 Thermex Red Head. The unit weighs only 250 lb. and is 15 in. wide, 23 in. high and 29 in. deep. It operates on ordinary 230-volt, 60-cycle, single-phase current. It is claimed that the unit is capable of raising the temperature of one-third of a pound of average molding material 170 deg. F. in one minute. The operation is completely automatic once the material-containing drawer is pushed into place.

A NEW non-slip flooring brick known as Empire Emri-Tread has been announced by Empire Emery Corp., 18 East 41st St., New York 17, N. Y. The new brick is claimed to be suitable for use in many industries where slipping hazards are encountered.

PROTECTION against oils, most acids and alkalis is afforded by a new line of protective sleeves made of fabric coated with vinyl resins which have been added to the line of industrial clothing manufactured by The B. F. Goodrich Co., Akron, Ohio. The sleeves are of lightweight, pliable material, 16 to 17 in. long.

THE FIRST self-flaring coupling for flexible plastic tubing has just been announced by Packless Metal Products Corp., 31 Winthrop Ave., New Rochelle, N. Y. No flaring tools are required. The flare is formed as the members of the coupling are screwed together in one simple operation, assuring a uniform-walled flare. Couplings may be reused indefinitely. The coupling serves tube sizes of ¼ in. to ¾ in. O.D.

NEW WELDING PROCESS

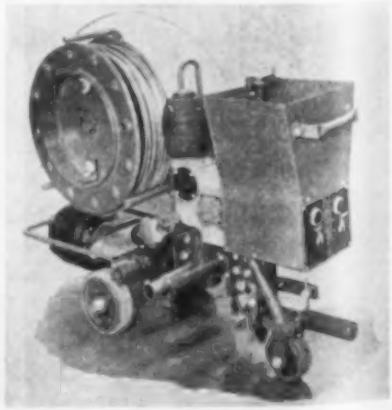
OFFERED under the name of "Lincolnweld," an improved process of automatic metallic arc welding has been developed and recently announced by the Lincoln Electric Co., Cleveland, Ohio. The new unit has had several years of test and has been applied extensively in numerous applications requiring the automatic welding of butt, lapped, and fillet welds of considerable length. The process employs extremely high direct current, as much as 650 amp., utilizing a bare metallic electrode which is fed through a granular flux deposited on the joint to be welded. This flux is applied so as to blanket the arc and metal completely and the unused flux is then reclaimed for further use. It is claimed that the new process is less sensitive to scale and moisture than conventional automatic welding methods, thus simplifying plate preparation. Exceptional weld quality is also claimed. The method is said to meet the requirements of important welding codes and to simplify welding through making one type and grade of flux, together with one analysis electrode, suitable for use with a wide range of steel analyses.

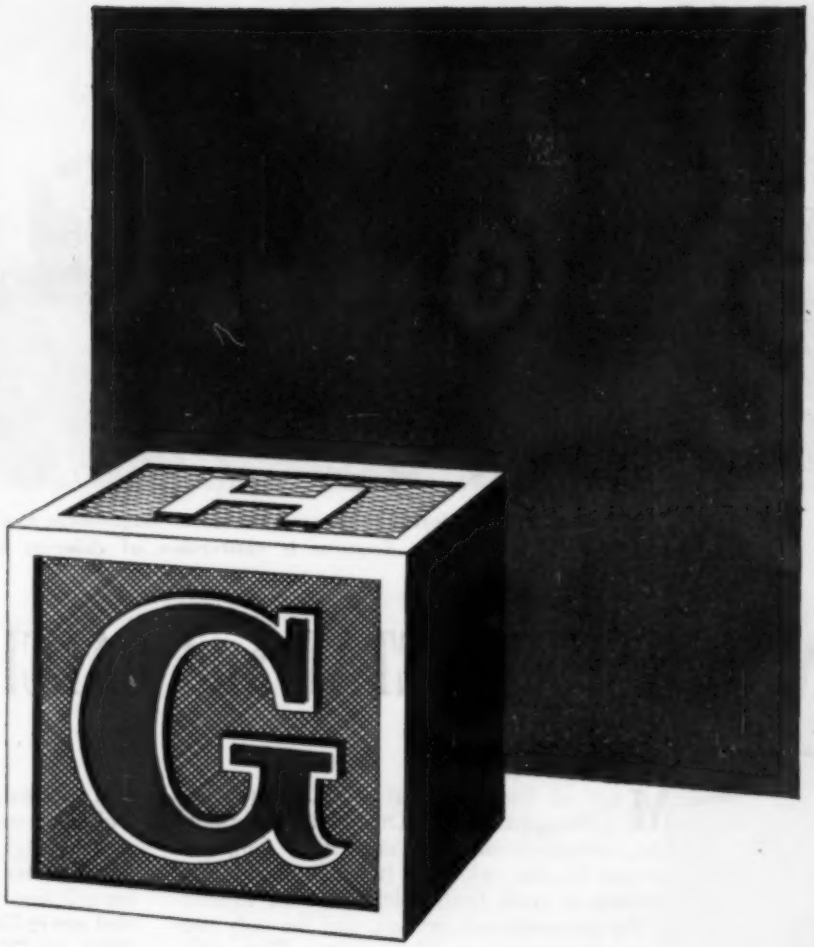
ELECTRONIC VULCANIZATION

AN ACCOMPANYING illustration shows part of the equipment for electronic vulcanization of rubber and other plastic materials that has been installed in the plant of the B. F. Goodrich Co., Akron, Ohio. Rubber vulcanization has often been suggested as a particularly good application for dielectric heating, since it is a difficult slow process to conduct heat from the outside into rubber, particularly into those forms which are good thermal insulators. For example, sponge rubber mattresses and pads have been vulcanized by the new process in one-eighth of the time taken by conventional vulcanizing methods. The company points out also that the ability to heat uniformly by dielectric heating is valuable in the molding of thick plastics products.

Electronic vulcanization equipment in the plant of B. F. Goodrich Co.

Automatic metallic arc welder





The first letter of the alphabet— when it comes to GAS PROCESSES

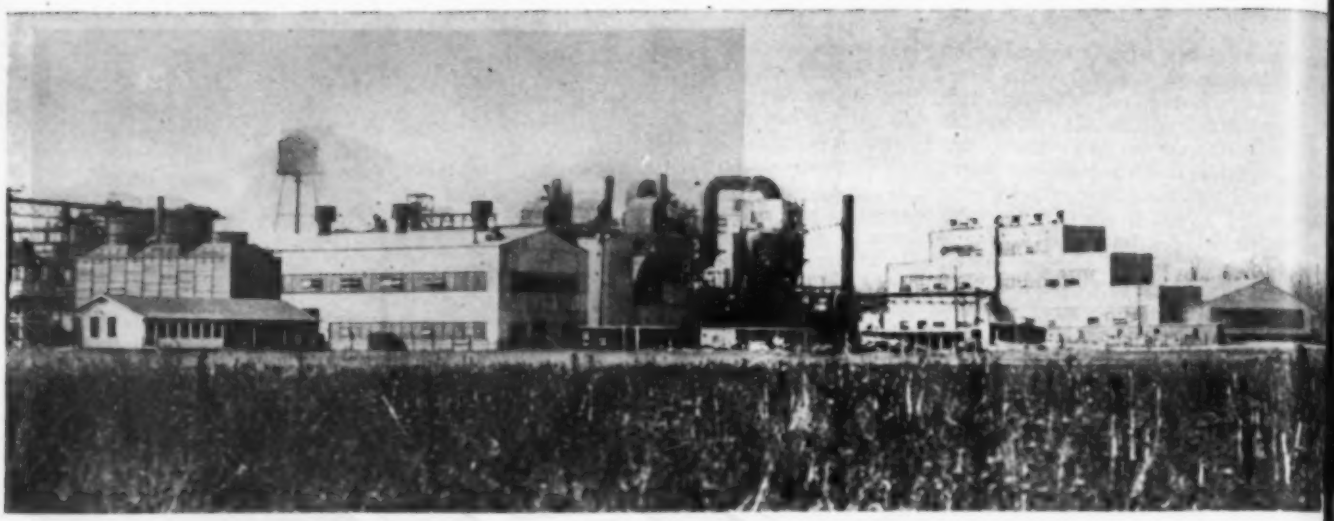
Most men who deal with the production and purification of gaseous mixtures or liquid hydrocarbons, when confronted with a new problem, think first of "G"—for Girdler. First in the field with many new developments, the Girdler organization has a reputation for being first also in engineering, research and development services. You will find it profitable to follow the example of leading chemical manufacturers and refiners all over America whose practice is to "Get Girdler on the job."

● *Girdler offers processes for gas manufacture, purification, separation and dehydration. Consult us on your problems concerning hydrogen sulphide, carbon monoxide, carbon dioxide, natural gas, refinery gases, liquid hydrocarbons, hydrogen, nitrogen. Originators of the Girbotol Process.*

CHEMICAL ENGINEERS AND CONSTRUCTORS

The GIRDLER CORPORATION

Gas Processes Division, Dept. CM-4 · Louisville 1, Kentucky



Calcium hypochlorite section of Diamond Magnesium Co.'s plant at Painesville, Ohio. One of the unique features is conversion of chlorine from cells into hypochlorite

MAGNESIUM METAL and CALCIUM HYPOCHLORITE

MANY of the operations at the Painesville, Ohio, plant of the Diamond Magnesium Co., subsidiary of Diamond Alkali Co., are unique. It is the only plant in which magnesium chloride is made from dolomite as an adjunct of the ammonia-soda process, and the only one in which byproduct chlorine from Dow cells is recovered for use in the production of calcium hypochlorite.

The process was designed so as to take maximum advantage of existing plant and operations by making the production of magnesium tie in with the soda ash operations in such a way as to make use of the lime (CaO) value of calcined dolomite.

Dolomite is calcined to dolomitic lime in vertical mixed-feed kilns in order to obtain high-strength tail gas (about 40 percent CO_2) for use in the production of magnesium chloride and in the ammonia-soda process. Hydrated dolomitic lime is treated with ammonium chloride to form a slurry of magnesium hydroxide, calcium chloride and sodium chloride—with ammonia being driven off by steam to be returned to the ammonia-soda plant. The slurry, after proportioning and removal of excess $CaCl_2$ and NaCl, is treated with carbon dioxide (rich tail gas from the vertical lime kilns) in carbonating towers. Further processing involves thickening and filtering to remove precipitated calcium carbonate, leaving a solution containing 10 percent magnesium chloride and some sodium chloride. Evaporation to 35 percent $MgCl_2$ precipitates the NaCl, and the $MgCl_2$, after evaporation to dryness, is suitable for cell feed. The reduction to the metal is carried out in Dow cells. (See *Chem. & Met.* Nov. 1941, pp. 76-84.)

In the magnesium cells about 40 percent of the chlorine is evolved in the form of HCl. The gases are heavily diluted with air and considerable carbon dioxide is present. It was found that the gas could be cooled and stripped of HCl by countercurrent contact with cooled water in scrubbing towers. Chlorine could be absorbed from the stripped cool gas, without much adverse effect from carbon dioxide, in modified Pease-Anthony absorption towers. Both caustic soda and lime slurry are used in the absorption units to produce hypochlorite solutions efficiently, with very low chlorine content in the tail gas. The process thus involves separate production of chlorinated lime and caustic soda solutions and the mixing of these in suitable proportions to bring about the formation of stable $Ca(OCl)_2$ and harmless NaCl. The calcium hypochlorite-sodium chloride mixture is then produced as a fine powder by spray drying.

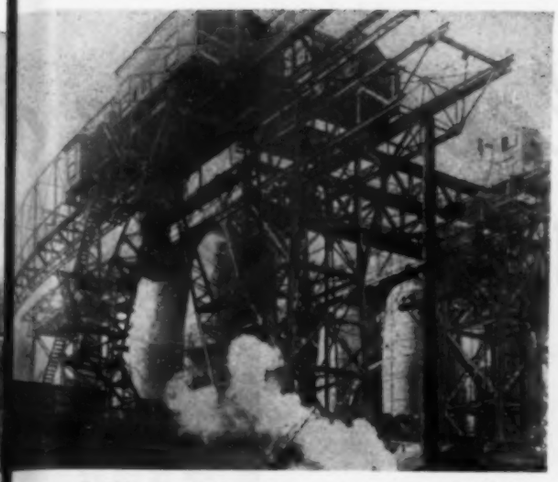
For more details of the processes in use by Diamond Magnesium Co. see pp. 94-96 of this issue of *Chem. & Met.*

A *Chem & Met* FLOW SHEET

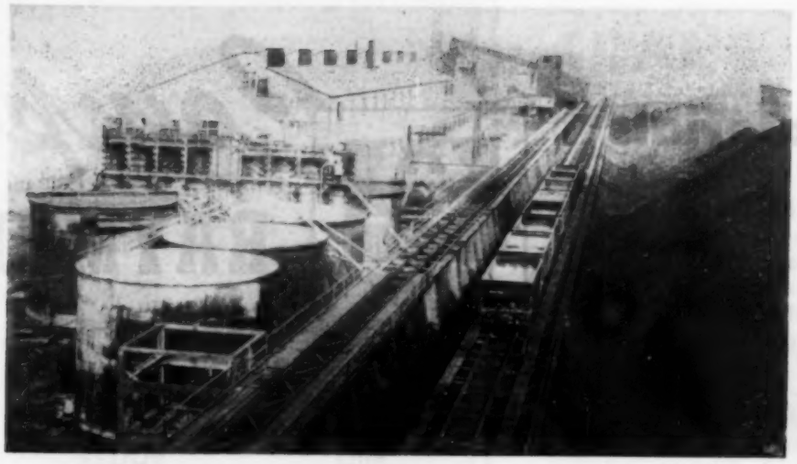
CHEMICAL & METALLURGICAL ENGINEERING

APRIL, 1945

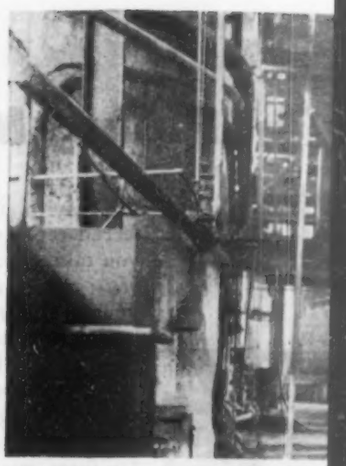
PAGES 130 to 133



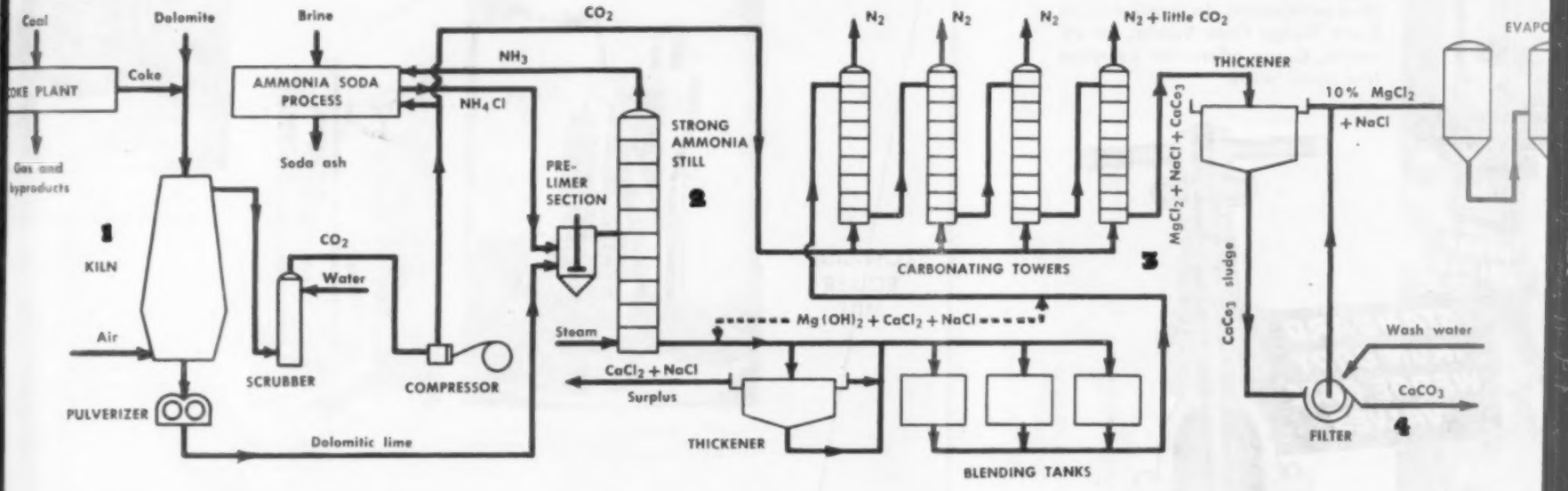
lcining of dolomite is done in vertical mixed-feed kilns
er to obtain high-strength tail gas



3 Magnesium chloride department. Slurry is treated in settling tanks, carbonated, thickened, filtered, and evaporated to 35 percent magnesium



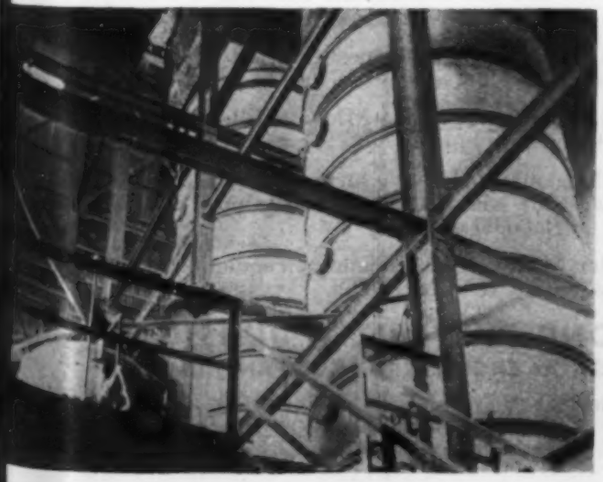
5 The 10 percent magnesium c
percent strength for delivery to

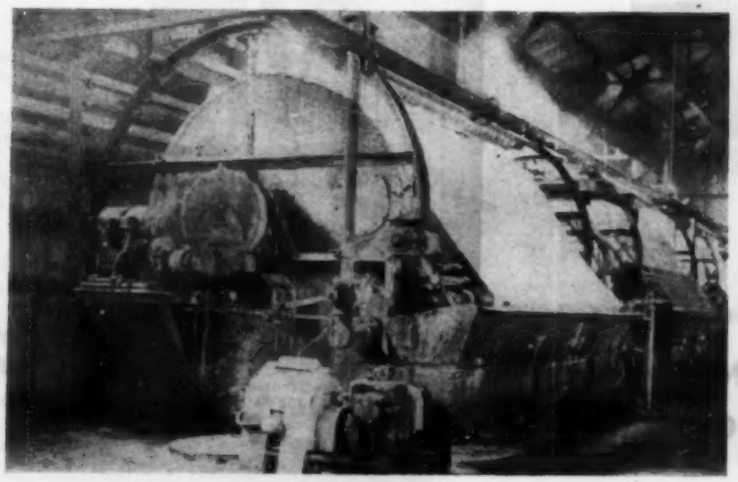


slurry of magnesium hydrate, calcium chloride and ammonia
ated in a still. Steam removes the ammonia

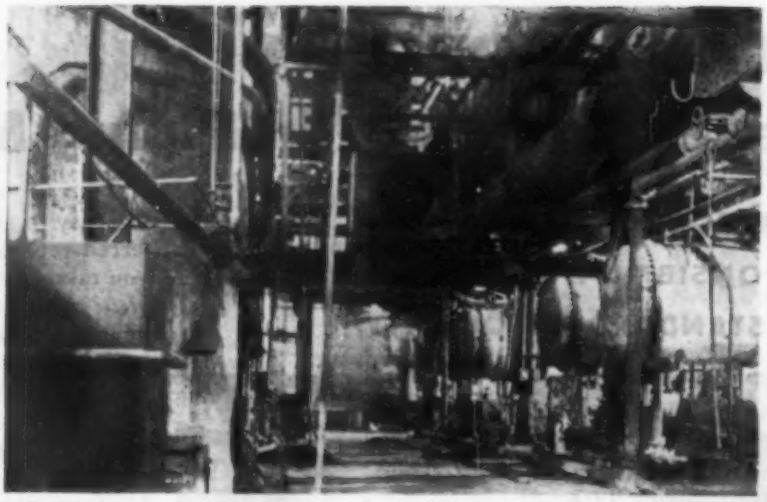
4 After carbonated slurry is thickened precipitated calcium carbonate is removed by filtration leaving 10 percent magnesium chloride

6 Strong magnesium chloride sol
After purification the solution is rea

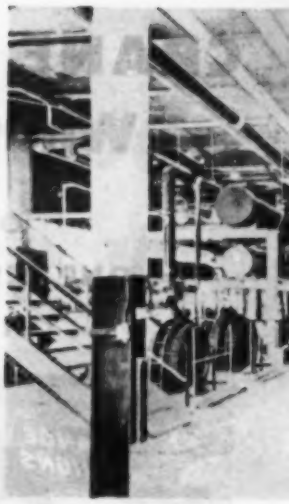




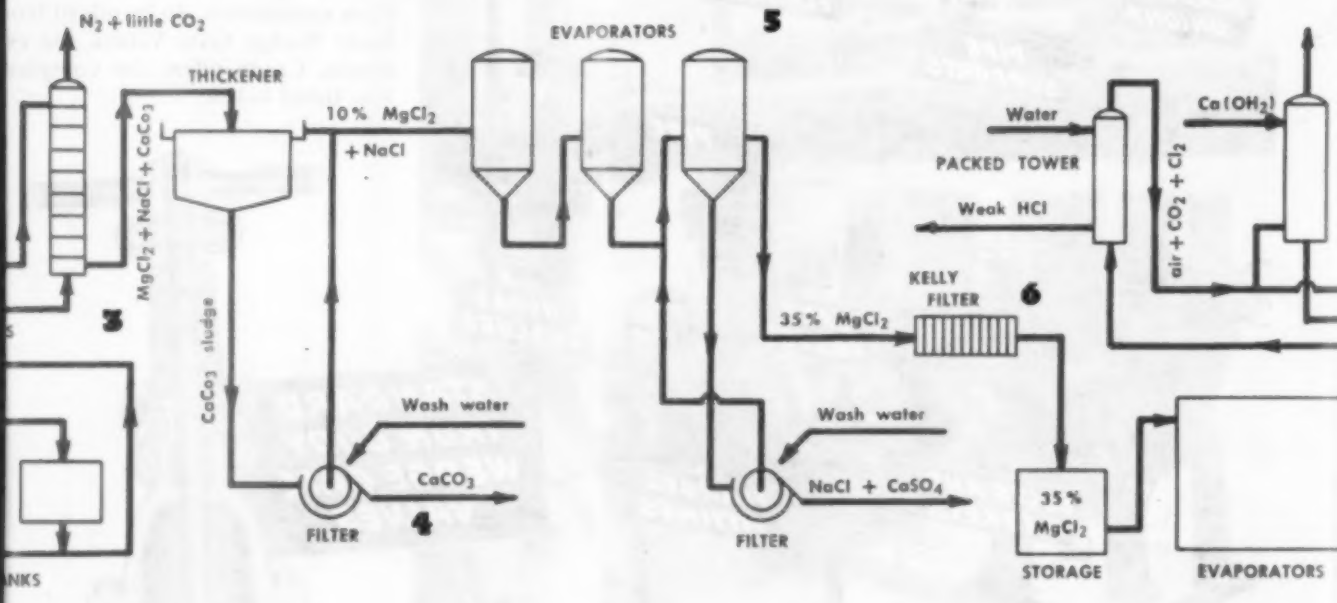
tling tanks, car-
t magnesium



5 The 10 percent magnesium chloride solution is evaporated to 35 percent strength for delivery to the magnesium cell plant



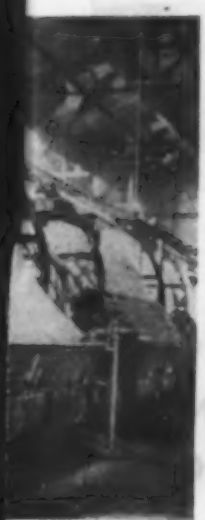
7 Interior of calcium hypo
used to mix the NaOCl and

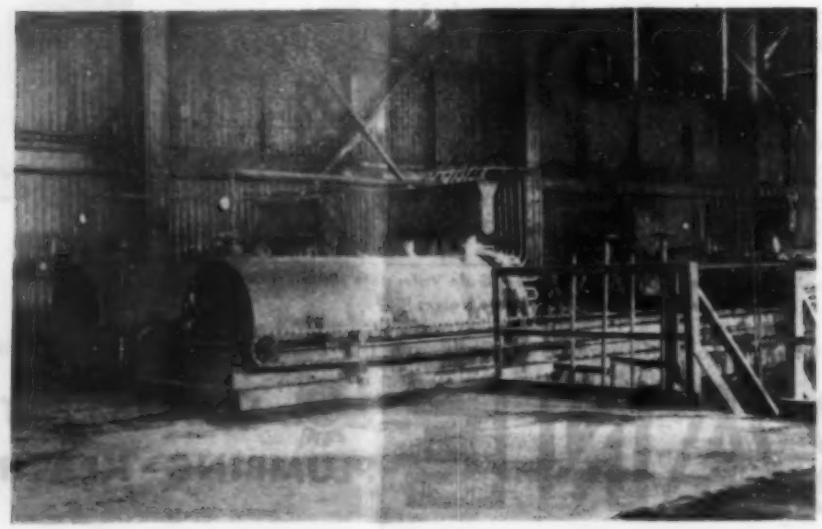


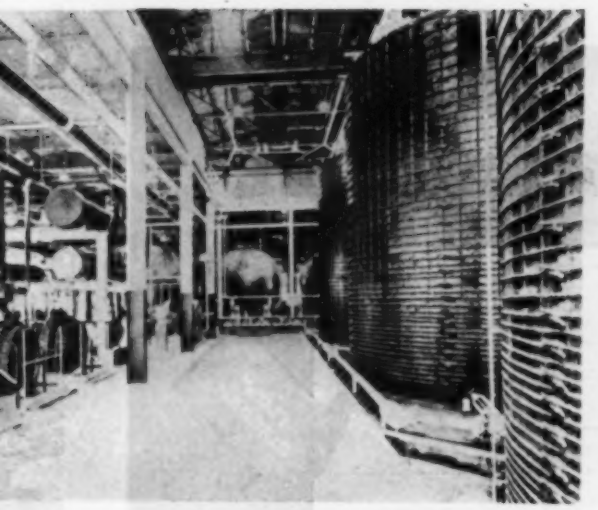
ium carbonate
hloride

6 Strong magnesium chloride solution is polish-filtered to remove salt. After purification the solution is ready for conversion to cell feed

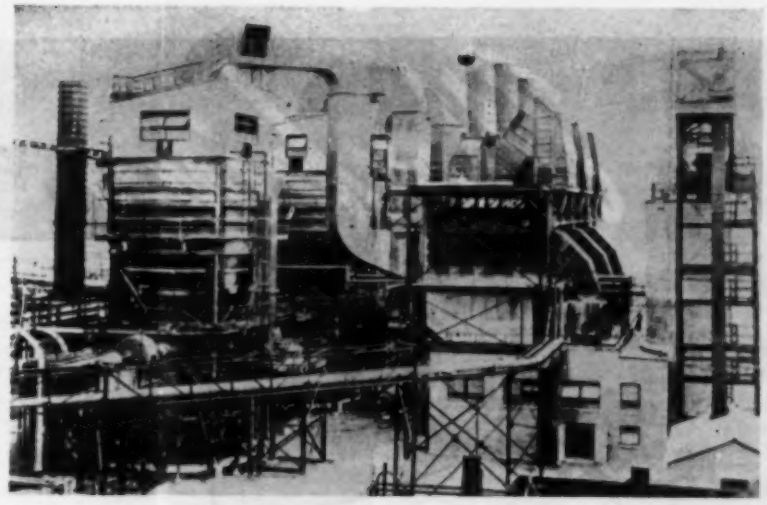
8 Spray dryer coal-fired
dryers for an unstable co



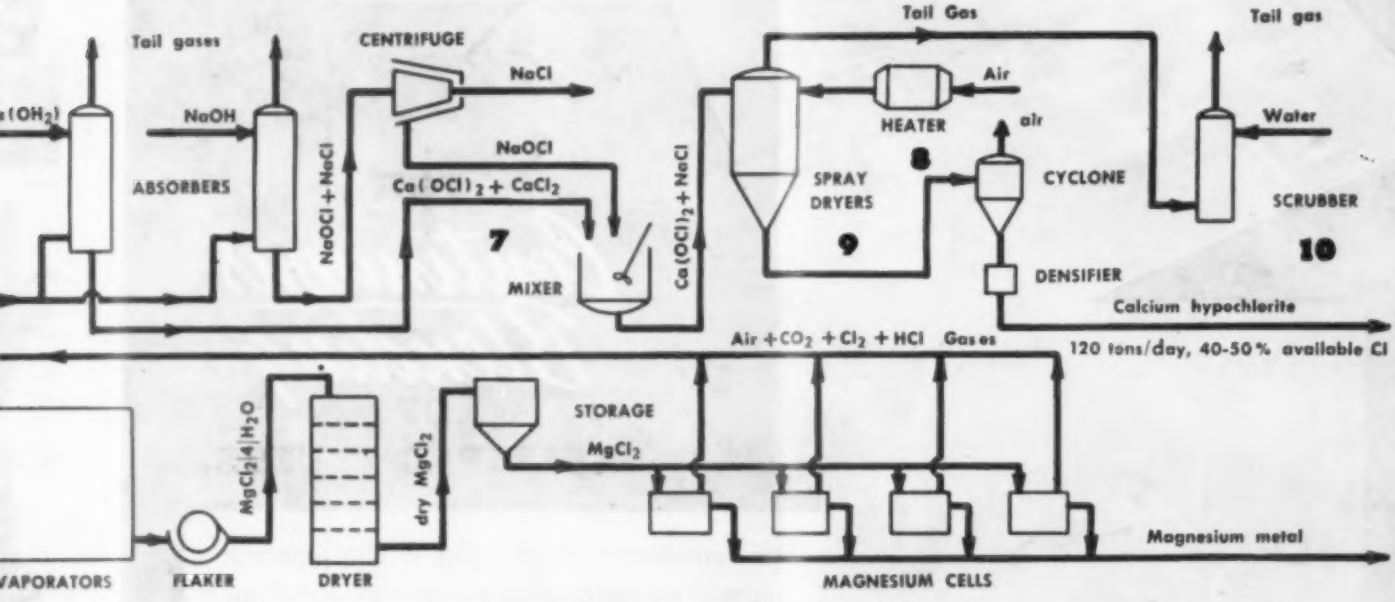




alcium hypochlorite department showing the large tanks NaOCl and $Ca(OCl)_2$ liquors before drying

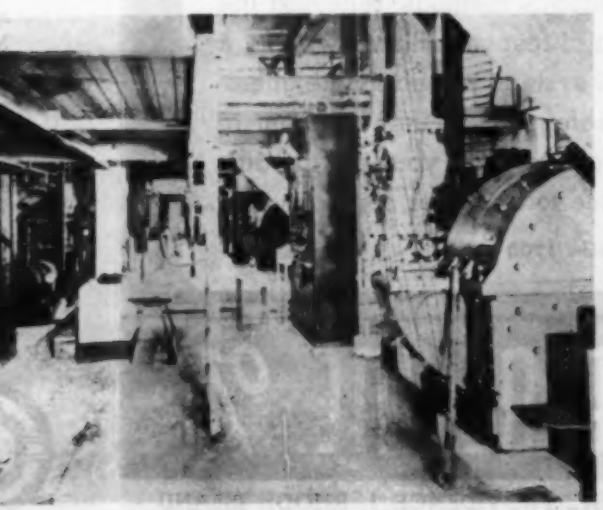


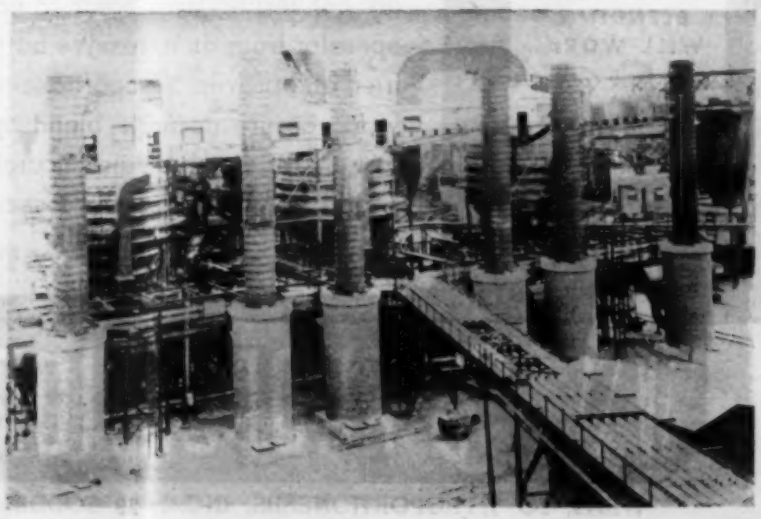
9 Dryers and air heaters. Final design called for three spray dryers, each with an evaporating capacity of 90 tons of water per day



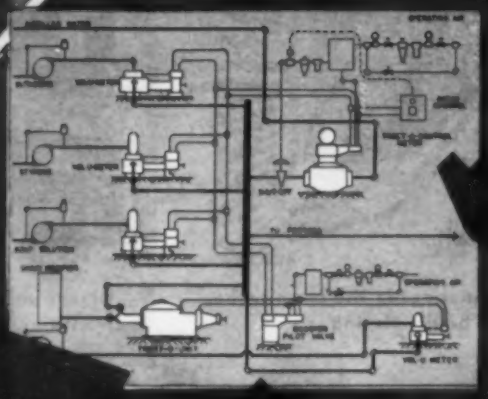
er coal-fired furnaces. Design of large capacity spray unstable compound presented special problems

10 Product is dried to 1 percent moisture by direct contact with indirectly heated air. Spray dryer tail gas scrubbers are shown

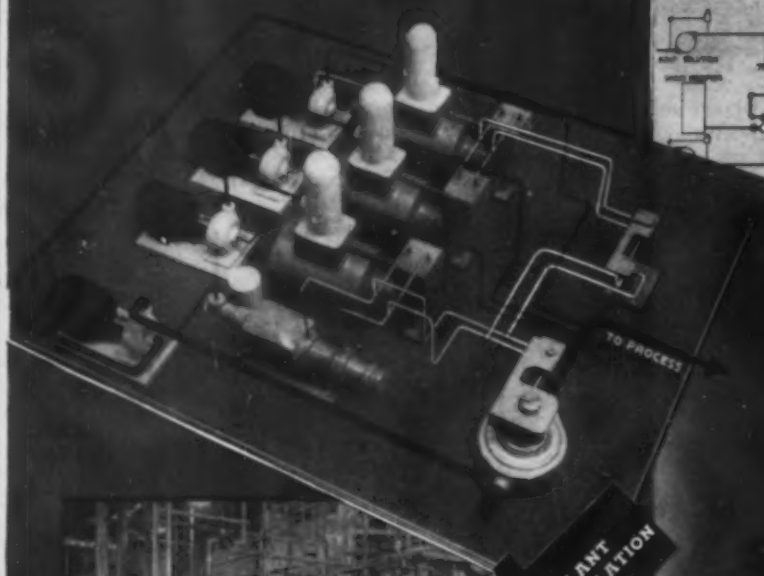




A Working PRINCIPLE



FLOW DIAGRAM



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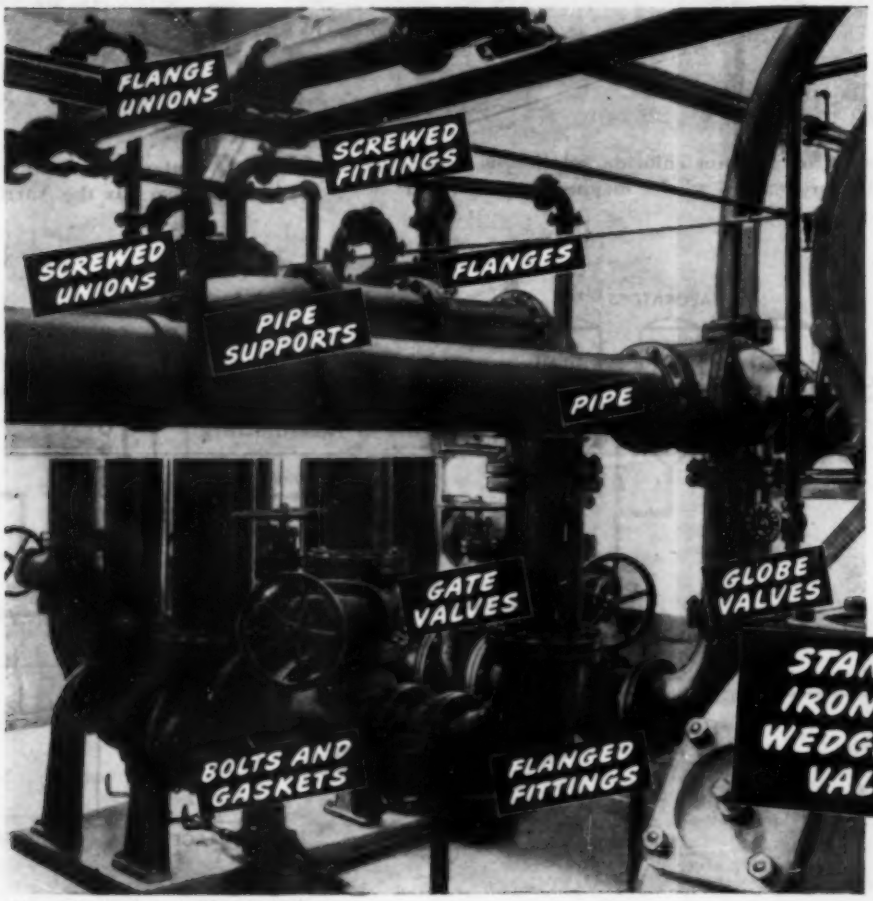
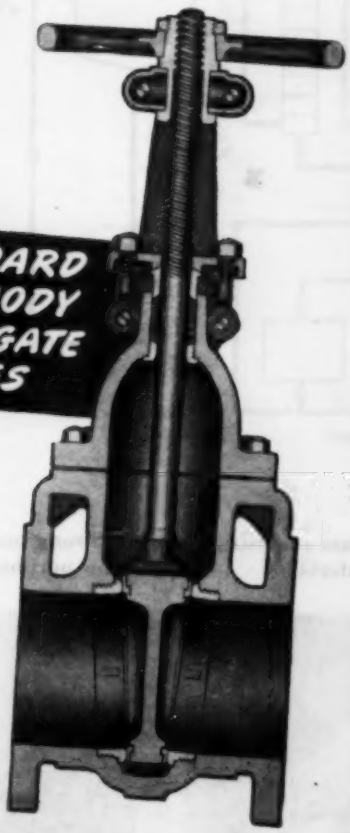


Aftercooler hook-up in Chemical Plant



SERVICE RECOMMENDATIONS: **Crane Standard Iron Body Wedge Gate Valves** with Brass trim are recommended for steam, water or oil lines; all-iron valves for oil, gas or fluids that corrode brass but not iron. Made in O.S. & Y. and Non-Rising Stem patterns.

Working Pressures

Size of Valve	Screwed or Flanged End Valves		Hub End Valves
	Saturated Steam	Cold Water, Oil or Gas, Non-Shock	Cold Water or Gas Non-Shock
2 to 12 in.	125 pounds	200 pounds	200 pounds
14 and 16 in.	125 pounds	150 pounds	150 pounds
18 to 24 in.	*	150 pounds	150 pounds

*For steam lines larger than 16-in., Crane 150-Pound Cast Steel Gate Valves are recommended. (For sizes under 2-in., use Crane Clamp Gate Valves.)

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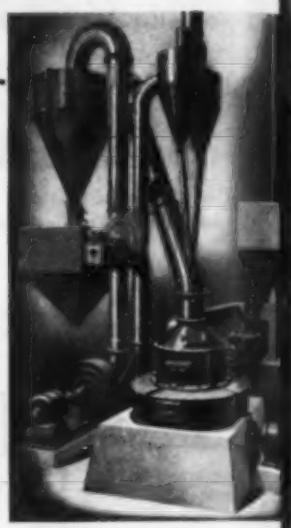
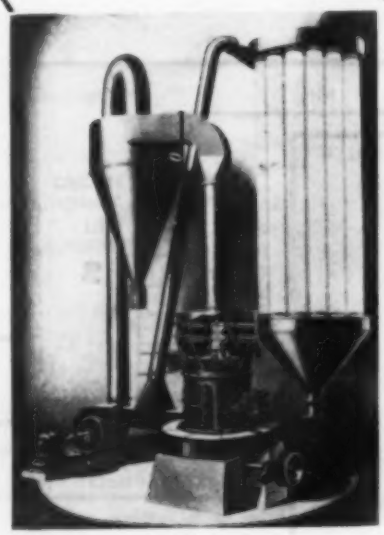
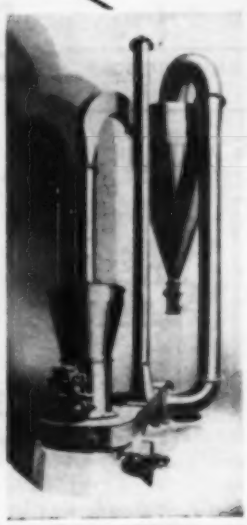


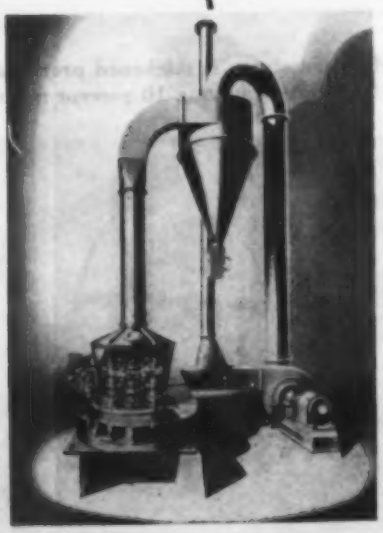
Largest Roller Mill built. Fo
put of "carload per hour." M
equipped with drying syste



Whizzer-equipped Roller Mill for super-fine grinding of chemicals, pigments and manufactured products.



For small capacities, this Midget type machine gives typical Roller Mill Economy.



For medium fine grinding, from 20-mesh to 100-mesh materials.

For precision production of powdered materials . . . as required in the chemical, food and process industries . . . there is a size and type of Raymond Roller Mill to handle a wide range of standard and special operations.

For extreme fine pulverizing and easy fineness control . . . the High-Side Mill with whizzer separator.

For medium grind up to 100-mesh fineness . . . the Low-Side Mill with standard air separation.

For small capacities . . . the Midget Mill. For large capacities up to 40 tons per hour . . . the Super Roller Mill.

For handling materials with surface moisture . . . the Raymond Roller Mill with an air drying system . . . to dry and grind in a single operation.

The Roller Mill with a half-century reputation of successful performance is the RAYMOND.

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NEW PRODUCTS AND MATERIALS

JAMES A. LEE, Managing Editor

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PLYWOOD GLUES

Two NEW resin glues have been added to the line of wood adhesives manufactured by Synvar Corp., Wilmington, Del. These resins, both of the phenol-formaldehyde type, are called Synvaren CP-5 and Synvarite PCP. The former is a liquid, water soluble resin; while the latter is a resin with the same characteristics, in powder form, which can be dissolved in water or alcohol. The liquid resin has the advantage of being "ready to use"; while the powder resin has the advantage of longer storage life.

Both resins can be used for soft or hard plywood bonding at high temperatures, when a short curing cycle is required, without addition of any hardener. By the use of a special hardener, LS, plywood bonding and lamination can be carried out at temperatures as low as 150 deg. F. They can be used straight or extended with walnut shell flour to reduce the cost of the glue line. The bond is strong and durable and shows an average of 90-100 percent wood failure.

RUBBER PLASTIC

"A CROSS between plastic, rubber and wood," is the best short description for a material, called Styraloy, now being produced in a new million dollar plant by the Dow Chemical Co., Midland, Mich. Styraloy is made from styrene and butadiene, the two compounds which are used in the manufacture of buna-S synthetic rubber. But a chemical mystery is the fact that, unlike natural or synthetic rubber, Styraloy cannot be vulcanized.

Styraloy is manufactured in the form of a dark, blue-gray powder to form products which have varying degrees of hardness, from nearly as soft as rubber to very hard and tough. Because of its versatility, says the company, it can be used to make everything from insulation in electric cable to water pipes that will not burst when frozen, unbreakable cigarette cases, shotgun shells, toys and door knobs. So light that it floats on water, the new rubber plastic has exceptional electrical properties, can be worked like wood, and as a molding powder lends itself to all common forms of plastic fabrication.

In the molding field, pipe fittings, bushings and antenna insulators are being fabricated from Styraloy. Its elongation is useful where metal inserts are involved because it will withstand wide temperature variations without cracking. In compression molding, tough rubber-like sheets varying from $\frac{1}{32}$ in. to 1 in. in thickness have been formed. Sheets 0.005-0.06 in. thick have been made by the calendering process. Channels, angles, strippings, conduit pipe and rods are fabricated by extrusion. All common machining operations, drilling, turning, milling, sawing, boring, grinding and polishing can be applied. In assembly it can be cemented to itself, to similar plastics or to other materials with adhesive bonds. Friction welds develop strength equal to that of the plastic itself.

Among other features of the material are abrasion resistance better than shoe leather, low moisture absorption, and ability to remain flexible over a temperature range from —90 to well over 212 deg. F. Its electrical properties place it in the field of low-loss, low-capacitance, high dielectric strength insulating materials. Many of these desirable properties are conferred upon synthetic rubbers and thermoplastics when Styraloy is used as a compounding ingredient. It can be made in all colors by mixing with dyes or pigments.

The product has been in limited production for some time, but for a military use which precluded earlier announcement of its development. With the opening of a new plant near Midland, Mich., it is expected that manufacture will soon be on a mass production basis.

Styraloy, a rubber-like plastic material developed during the war by the Dow Chemical Co., is exhibited by D. L. Gibb of that company

DRYING OIL FROM SOYBEANS

A NEW drying oil for the protective coatings industry is now being manufactured from soybean oil by Spencer Kellogg & Sons, Buffalo, N. Y. The new product puts processed soybean oil finally and reliably into the drying oil class, with properties generally equal to linseed oil for paint, varnish and synthetic resin manufacture. It is expected that the new oil, trade-named Drisoy, will compete with linseed varnish oils both during the emergency and after free markets are restored following the war.

Drisoy is furnished in two viscosity types: "A" of F-G viscosity, and "B" of D-E viscosity. Drisoy-A is recommended generally for the same types of paints and varnishes in which linseed is used. Drisoy-B having lower viscosity, is particularly adapted to the making of alkyds.

Experimentation with standard varnish formulations shows, for example, that in "25 gal." length varnishes, comparable lots show practically equivalent setting time for Drisoy and linseed varnish films, and that for hard-dry films the setting time of the new oil is only slightly greater. The development of Drisoy has reached the production stage, and while wartime restrictions prohibit the use of soybean oils in paints and varnishes generally, experimental quantities are available to manufacturers of protective coatings.

POLYVINYL CHLORIDE PLASTICIZER

COMMERCIAL scale production of a new ester type plasticizer which imparts a high degree of flexibility to vinyl coated fabrics subjected to low temperatures such as those used in strip coatings, free films, and insulation jackets, is announced by the Resinous Products & Chemical Co., Philadelphia, Pa. Known as dioctyl sebacate, the material is a high-boiling, stable, light-colored liquid which combines the low temperature flexibility associated with dibutyl sebacate with the non-volatility of dibenzyl sebacate.

The material cannot be extracted by water, but like almost all monomeric esters, it is not resistant to oils. Polyvinyl chloride films containing it exhibit low flam-

mability resistance. Plasticizing efficiency (100 percent modulus) of dioctyl sebacate is intermediate between that of dibutyl sebacate and dioctyl phthalate.

Standard polyvinyl chloride stocks containing 35 percent dioctyl sebacate, like dibutyl sebacate stocks, possess a bend-brittle point below —70 deg. C. as compared to —50 deg. C. for dioctyl phthalate. The bend-brittle point is determined by storing strips of the stock 0.080 in. thick at —30 deg. C. for 24 hr. These specimens are then immersed in a methanol-dry ice bath, held at the test temperature for five min. then rapidly flexed through a 90 deg. bend over a ½-in. mandrel. Tests are repeated at decrements of 5 deg. C. until the specimen cracks. The bend-brittle point is the temperature 5 deg. C. above the cracking point.

The combination of plasticizing efficiency, low volatility and good water resistance works advantageously in the manufacture of polyvyinyl chlorine coating films used as protective wrappings for material subjected to climatic variations and temperature extremes. Other applications include electrical insulation jackets and such coated fabrics as shower curtains and rainwear.

PHENOLIC ADHESIVE

A LOW-TEMPERATURE phenolic adhesive which cures at room temperature has been developed by Reichhold Chemicals, Inc., Detroit, Mich. It is claimed that the adhesive cures at temperatures as low as 75 deg. F. in a reasonably short time, and results in a bond resistant to boiling water, prolonged immersion in water, alcohol and almost all solvents except strong alkalis and oxidizing acids. Known as No. 6000 Plyophen, it meets the requirements of Army Air Force Spec. 14124 and other specifications for low-temperature, wood bonding adhesives.

It is particularly adaptable for bonding large prefabricated sections, such as parts of army gliders, which cannot be placed in a press. Other present applications are aircraft spars, heavy duty construction arches, ship timbers, laminations of heavy lumber, and many other aircraft and marine constructions.

No. 6000 Plyophen is a relatively stable liquid and is prepared for use by mixing it, just prior to use, with a catalyst powder consisting of a formaldehyde-containing substance and an inert organic filler. Plyophen liquid contains approximately 60 percent solids. The solvent is alcohol and water, and the resin may be diluted if necessary with either alcohol or water. Liquid and powder are mixed in a ratio of 100 to 20, respectively.

Pot-life of the mixed adhesive is approximately 2½-3 hr. at 75 deg. F. and 1-2 hr. at 85 deg. F. Special precautions, therefore, should be taken in warm weather to keep the mixture cool. The recommended spread of the mixed adhesive is between 45 and 60 lb. per 1,000 sq.ft. of glue line, depending on the density of the wood. An open assembly time of 5-10 min. is desirable, but pressure should be applied within 20-30 min. to prevent the resin from hardening prematurely. Pressures as low as 25 psi. may be employed, particularly with low-density wood.

Typical test data for the strength of veneer panels are shown in the accompanying table, which also gives some indication of the time-temperature relationship in various curing cycles.

PLASTIC LAMINATE

A PLASTIC laminate found to be stronger and lighter than the usual aluminum alloys used in airplane manufacture has been developed by research engineers for the Consolidated-Vultee Aircraft Corp. Called Conolite, the product is made by impregnating Fiberglas or Fortisan fabric with a new type thermosetting resin. It is being used to fabricate parts for Liberator and Dominator bombers, though according to reports it is still an experimental project.

Specimens have been immersed in salt water, benzene, aromatic fuels and acetone for from 24 to 48 hr. without sign of deterioration and have exhibited high resistance to all types of resonance. Conolite has a reported tensile strength of 120,000 psi. Its sp.gr. is 1.64, and it is capable of being "cured" in numerous shapes.

RESINS FOR LACQUERS

PROCESSING difficulties in the grinding of nitrocellulose lacquers have prevented many firms from grinding pastes in their own equipment. The use of highly volatile solvents normally required in synthetic resins is unsatisfactory from a safety standpoint, and the relatively poor wetting characteristics of the usual vehicle has made pigment incorporation without solvent a difficult problem on the usual roller mill. As a solution to this problem, the Resinous Products & Chemical Co., Philadelphia, is offering Paraplex RG-8, an unallocated, long oil type alkyd resin designed as an all purpose grinding medium for nitrocellulose pastes and developed to eliminate the use of dangerous solvents and special equipment. The resin is low in cost and is said to demonstrate excellent pigment wetting properties, thus requiring no equipment other than the standard roller mill employed in paint production. Resulting pastes are "long," as opposed to the short "buttery" pastes obtained with castor oil.

Paraplex RG-8 is a plasticizing type alkyd resin which in the 100-percent form has a viscosity similar to that of the high viscosity, non-drying, blown oils commonly used in lacquers. Since the resin has an acid number below 3.5, pigment reactivity is not a factor and zinc oxide or Prussian blue may be used without danger of thickening or livering. In most cases, no solvent of any type is required. However, where solvents are desirable, the higher boiling aromatics such as toluol, which are ultimately used as a diluent in the finished lacquer, may be used for paste grinding. In contrast to the limited compatibility of the high viscosity, non-drying, blown oils extensively used, Paraplex RG-8 is said to be highly compatible with nitrocellulose, ethyl cellulose, polyvinyl butyral and chlorinated rubber, but not with vinyl resins. Since it is also compatible with many phenolic-type hard resins, nitrocellulose blends can be formulated readily and such blends have good adhesion, fullness, gloss and durability.

In the 100-percent form, Paraplex RG-8 is under no allocation restriction and is subject only to the availability of castor oil.

GENERAL PURPOSE ADHESIVE

IN EITHER heat-sealing or wet-stick operations, a versatile new adhesive called Syn-Tex No. 2113, is said to provide an extremely strong bond and a thoroughly flexible film. The manufacturer, Dennis Chemical Co., St. Louis, Mo., claims the adhesive is effective on wood, fabric, leather, paper, and on painted or lacquered surfaces. It may be used in concentrated form or diluted for use in gumming machines, spreaders, spray guns or flow methods. It may also be applied to both surfaces, allowed to dry, and the seal effected by pressing the gummed surfaces together under heat.

Syn-Tex No. 2113 is a free flowing, white emulsion of modified synthetic resin bases. When dried, it leaves a glossy, semi-transparent film.

FLUORESCENT TEXTILE

RECENT lifting of military secrecy on a spectacular discovery in the field of textile chemistry offers an explanation for the consumption of what had seemed to be fantastic quantities of a "luxury" fabric, cellulose acetate satin. Millions of yards of it are being fabricated into photo-luminescent signal devices used by ground troops and carrier crews to communicate with their aircraft. The devices are based on the

Bond Strength of Veneered Panels Glued With No. 6000 Plyophen

Curing Temp., Deg. F.	Curing Time, Min.*	Pressure, Psi.	Average Break Tests, psi. and (% wood failures) Samples Dry	Samples Boiled† 3 Hr. in Water	Samples in Water 48 Hr., Room Temp.
Birch Test Panels Made of Three 1/16-in. Veneers:					
75	360	50	487 (20)	606 (100)	690 (100)
75	360	100	530 (31)	567 (100)	550 (97)
140	12	200	505 (100)	440 (100)	410 (100)
160	4	200	440 (71)	470 (100)	523 (91)
180	1.5	200	500 (100)	506 (100)	574 (100)
Douglas Fir Test Panels Made of Three 1/10-in. Veneers:					
75	360	50	242 (100)	220 (100)	....
75	360	100	266 (100)	244 (100)	....
160	2	100	264 (100)	250 (100)	284 (100)
180	1.5	100	270 (100)	260 (100)	240 (56)

* Samples cured at room temperature were allowed to age for 3-4 days after removing pressure to develop maximum strength before testing. † In the case of Douglas fir, the boil test consisted of boiling 4 hr. in water, drying at 145 deg. F. for 20 hr., boiling 4 hr. more in water, and then cooling and testing. This is a DFPA test for exterior grade plywood.

Do your plans require

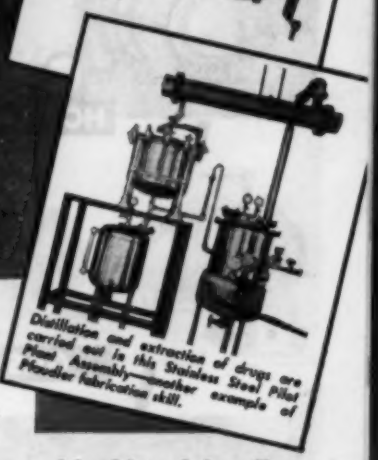
SPECIAL STAINLESS STEEL PROCESS EQUIPMENT?

Pfaudler glass-lined steel and alloy steel equipment is available in standard as well as custom-built designs. Following is a partial classification:

Agitators (with vessels)
Alloy Steel Equipment
Autoclaves
Blenders
Coils, Cooking, Cooling, Refrigerant
Columns
Condensers, Acid
Condensers, Reflux
Coolers
Coolers, Acid
Dispersers, Brewery
Crystallizers
Dissolvers
Dryers
Enclosures
Evaporators
Filtration Equipment
Filters, Rotary, glass-lined
Drying Tables
Gasholders
Generators, Vacuum
Absorbers
Fermentors
Filling machines (gravity flow and piston)
Fittings, Pipe, glass-lined
Heat Exchangers
Glass-lined steel equipment
Kettles, glass-lined, alloy steel
Kettles, reaction
Kettles, vacuum
Mixers and Mixing Vessels
Nutsches
Pans, crystallizing, evaporating
Pasteurizers: juices, milk
Percolators
Pipe, glass-lined steel
Polymerizers
Pressure Vessels
Reaction Equipment
Recovery Plant (Solvent)
Stills
Telpherchairs
Tanks, glass-lined, alloy steel
Towers, absorption
Truck Tanks
Vacuum Pans
Valves, glass-lined

Stainless Steel scrubbers built by Pfaudler for exacting duty in processing chemicals.

This Stainless Steel Milk Irradiator, with its mirror finish, is typical of Pfaudler fabricating skill.



Distillation and extraction of drugs are carried out in this Stainless Steel Pilot Plant Assembly—another example of Pfaudler fabrication skill.

Pfaudler Experience in Design and Fabrication of Stainless Steel and Alloy Equipment Has Helped Many Processors

In Pfaudler's standardized line of stainless steel process equipment, you may be able to get just the units you require for your operations. With the experience gained through many years of service to process industries, Pfaudler engineers have designed these Stainless Steel Reaction Kettles to include those features which are required for a majority of conditions. They have ample top head openings to accommodate incoming product lines, light, vapor take off, agitator, etc. These units are built in sizes from 5 to 500 gallons capacity. Here is a way to save costs on your equipment needs.

Should your plans call for special equipment entirely, let Pfaudler engineers design and build it of the alloy best suited to withstand your operating conditions. Sound design and workmanship are important factors in Pfaudler built equipment. A pioneer in the fabrication of stainless steel, Pfaudler has made many contributions to the technology of welding alloys. The type of custom-built equipment Pfaudler has fabricated is indicated in the column. Whether your specifications require high polish or mill finish, you are assured expert workmanship.

Bulletin No. 823 gives detailed descriptions of Pfaudler's standard stainless steel equipment and many of the custom-built units. A copy is available to you upon request.

Glass-Lined Steel Equipment: Where acid corrosion and product contact with metal must be avoided, specify Pfaudler Glass-Lined Steel Equipment. It is resistant to all acids (except HF) in any concentration and at high operating temperatures and pressures. Pfaudler Glass-Lined Steel Equipment is available in standard and custom-built units. Catalogs 810, 817, 828 and 829 will interest you.

Pfaudler Glass-Lined Steel Chlorinating Column furnishes the high resistance to corrosion that protects reagents and equipment. Built to withstand 125 PSI Internal Pressure, 50 PSI Jacket Pressure.

Pfaudler

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THE PFAUDLER CO., ROCHESTER 4, NEW YORK

ENGINEERS AND FABRICATORS OF CORROSION RESISTANT PROCESS EQUIPMENT

Glass-Lined Steel . . . Stainless Steels . . . Nickel . . . Inconel . . . Monel Metal

Measure AIR · GAS · LIQUID with Extreme Accuracy

Roots-Connersville Rotary Positive Displacement Meters are simple in design and of rugged, all-metal construction. The volume displaced *each revolution* of the impellers has been determined accurately for each size meter. This volume is fixed and unchangeable.

PERMANENTLY ACCURATE

This unchanging displacement means that the extreme accuracy of "R-C" Meters is PERMANENT. There are no valves, orifices, springs, buckets, diaphragms, or other light metal parts to wear or deteriorate and destroy the accuracy of measurement. Whether handling air, gas or liquid, the accuracy of "R-C" Meters is the same. Recorders can be furnished for direct reading in cubic feet, gallons, or any desired unit. Photos show just a few of the many applications for which Roots-Connersville Meters are regularly used.

OTHER IMPORTANT FEATURES

1 Accuracy maintained despite changes in moisture, specific gravity, or temperature of air or gas.

2 Variations in rate of flow from 5" to 150% of normal capacity do not affect accuracy.

3 Large capacity combined with compact size.

4 Negligible power and pressure absorption.

5 The longer life, minimum attention and maintenance requirements, and greater accuracy of "R-C" Rotary Positive Displacement Meters repay their cost many times over.

ROOTS-CONNERSVILLE BLOWER CORP.

ONE OF THE DRESSER INDUSTRIES

504 Illinois Ave., Connersville, Indiana

WRITE FOR THESE BULLETINS
LIQUID METERS..... NO. 40-B-15
AIR & GAS METERS..... NO. 40-B-13

Roots CONNERSVILLE SINCE 1854

Rotary Positive AIR GAS LIQUID Meters

ability of the impregnated fabric to convert ultra-violet and other high-frequency radiations from the sun into lower-frequency energy, emitted as colored light with resulting high visibility.

The impregnant which gives this property to acetate rayon is one of several new developments in the field of photo-luminescence made by Switzer Brothers, Cleveland research chemists. It is being manufactured under license by Conti-glo Div., Continental Lithograph Co., Cleveland, Ohio.

In the first stages of the war, Allied ground troops identified themselves to their air forces by forming code patterns on the ground with cloth panels. Early in the African campaign, the visibility of these was found to be dangerously inadequate when friendly ground troops were occasionally bombed in error. A common orange bunting, of the kind then widely used, appears orange because it reflects only the orange portion of the sun's rays, absorbing and thereby wasting all the rest. Conti-glo's photo-luminescent Fire Orange reflects similarly, but also converts much of the sun's ultra-violet, blue and green into orange. In the daytime, therefore, the light-transforming fabric directs several times as much light to the eye of the observer. Extensive battle testing has established that the new fabrics have a visibility under some adverse lighting conditions in excess of four times that of the nearest corresponding hue in ordinary signal fabrics.

It was early discovered by Switzer Brothers that daylight fluorescence resulted only when the impregnants (completely lacking in light-converting properties in their crystalline state) were dispersed throughout a filament capable of acting as a "solvent" for them, and continuing to hold them in a "solvated" state of molecular dispersion somewhat akin to liquid solution. Cellulose acetate alone among commercially available fabrics showed this capacity. The first light-transforming fabric offered was the comparatively delicate fabric satin, and it remains the only weave in U. S. specifications for the ground-air signal panels, though other allied forces have adopted a cellulose acetate fabric of somewhat more rugged weave.

The various photo-luminescent materials employed are complex organic compounds, having a common molecular nucleus. They have no chemical kinship with such inorganic fluorescent or phosphorescent materials as the radioactive salts, or with the inorganic materials employed for such purposes as coating the screens of fluoroscopes.

SYNTHETIC RUBBER PLASTICIZER

LIGHTNESS of color is the most interesting feature of a new softener and plasticizer for synthetic rubber developed by the C. P. Hall Co., Akron, Ohio. It is called Para Lene-W and is said to be a modified form of the company's older product, Para Lene.

In almost every respect, the new product tests equal to the old, and in addition has been so prepared that it meets the demand for a plasticizer usable in light-colored GR-S stock and in black stocks which must not stain white finishes.

TWINS AVAILABLE

The twin compounds, cyclohexylamine and dicyclohexylamine, can be shipped immediately . . . in commercial quantities . . . by Monsanto.

Cyclohexylamine has applications in the fields of corrosion inhibitors, paint film solvents, emulsifying agents, petroleum, dyestuffs and chemical manufacture. It has possible uses in the manufacture of plasticizers, as a curing agent for soya bean molding powders, as a color stabilizing agent in vinyl resins, in dry-cleaning soaps, as a blending agent for alcohol-gasoline mixtures and in the manufacture of insecticides.

Dicyclohexylamine is used in extreme-pressure lubricants, in the manufacture of cutting oils and in the production of chemicals. Some derivatives have special application as insecticides.

For technical data, and samples of these low-priced alicyclic amines, contact the nearest Monsanto office or mail the coupon to MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second Street, St. Louis 4, Missouri. District Offices: New York, Chicago, Boston, Detroit, Charlotte, Birmingham, Los Angeles, San Francisco, Seattle, Montreal, Toronto.

(These suggested uses are for illustration and are not to be construed as recommending violation of any patent.)

CYCLOHEXYLAMINE

(Also known as hexahydroaniline)

Clear, practically colorless liquid.

Distilling Range	132.0 to 137.5°C
Sp. Gr. at 15.5/15.5°C	0.870 to 0.874
Flash Point (by "Tag" open cup)	90°F
Fire Point (by "Tag" open cup)	90°F

Cyclohexylamine is a primary amine, being more aliphatic than it is aromatic in nature.

DICYCLOHEXYLAMINE

Clear, practically colorless liquid.

Distilling Range	252.0 to 258.0°C
Sp. Gr. at 15.5/15.5°C	0.916 to 0.920
Flash Point (by "Tag" open cup)	Above 200°F
Fire Point (by "Tag" open cup)	Above 200°F

Dicyclohexylamine, a strong base, is only slightly soluble in water. It is soluble in all common organic solvents.

FREE SAMPLES and TECHNICAL LITERATURE

MONSANTO CHEMICAL COMPANY
Dept. I-6, Organic Chemicals Division,
1700 S. Second St., St. Louis 4, Mo.
Please send me your free technical bulletin No. 27 on Cyclohexylamine and Dicyclohexylamine and samples as indicated: ☐ Cyclohexylamine; ☐ Dicyclohexylamine.

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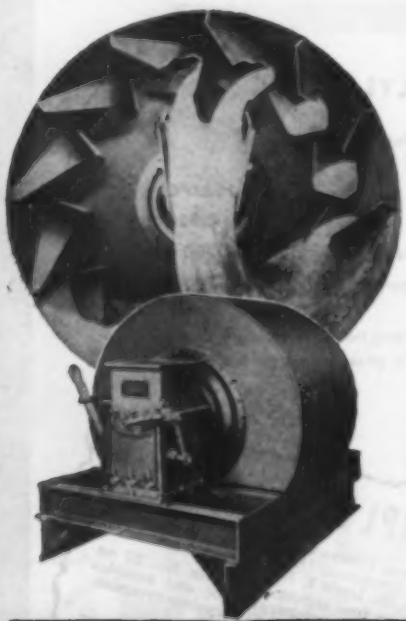
Company_____
Street_____ Zone_____ State_____
City_____

MONSANTO CHEMICALS
SERVING INDUSTRY...WHICH SERVES MANKIND

The STURTEVANT DRY BATCH BLENDER eliminates "AIR-FLOAT"

"Air-float" means light substances float in air, remain unmixed with heavier particles. Result—an imperfect batch of chemicals, dyes, ceramics or whatever you're blending. "Air-float" can't happen in the Sturtevant Dry Batch Blender. The revolving drum develops a 4-way mixing action. Nothing escapes. Nothing floats free. You get a perfect blend of all particles.

Every batch completely blended..



The STURTEVANT eliminates "air-float" as well as loss of dust of finely ground materials. Every batch is uniform, perfectly blended—regardless of variation in weight, density, fineness, whether dust or granules. The opening for both intake and discharge is closed during blending. Capacities: 1000, 2000, 3000, 6000 and 7500 lbs. Simplicity of operation in all models is combined with strong, rugged construction.

WRITE today for bulletin 080B. No matter what your problems of Crushing, Grinding, Separating (Screen and Air), Mixing, Acidulating, Elvating and Conveying, there's a Sturtevant Product to do the work better—at lower cost. Ask us to send appropriate Bulletins.

Sturtevant MILL COMPANY
HARRISON SQUARE BOSTON, MASS.
CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS
MECHANICAL DENS and EXCAVATORS • ELEVATORS • MIXERS

Specifically, the old and the new products are said to be equal in point of plasticizing action on GR-S, aging properties, and non-influence on the rate of cure of GR-S.

Tentative specifications for Para Lene-W include acid and iodine numbers less than 20, ash less than 0.5 percent, less than 1 percent soluble in acetone, flash point above 350 deg. F. and pour point below 70 deg. F.

SODIUM N-CHLOROBENZENE-SULFONAMIDE

CHLORAMINE-B is one of the "undiscovered-commercial potential" active chlorine compounds produced by Wyandotte Chemicals Corp., Wyandotte, Mich. Suggested uses, however, include: pharmaceutical preparations and sanitizing agents, textile germicides and deodorants, mild bleaching agents, mold and slime eradicators, fungicidal agents and oxidizing agents. In the textile field it is applicable to cotton, rayon and wool, and is reported to have no effect on many dyestuffs at the proper pH and concentration. Its bleaching action is readily controlled by varying pH and concentration.

The compound is water-soluble and the pure material has an available chlorine content of 29.47 percent. It is stable under ordinary storage conditions and its water solution is said to retain its chlorine well, even at elevated temperatures. The chlorine is readily available, however, and its activity can be regulated by pH adjustment. Commercial quantities are available.

Properties of Chloramine-B

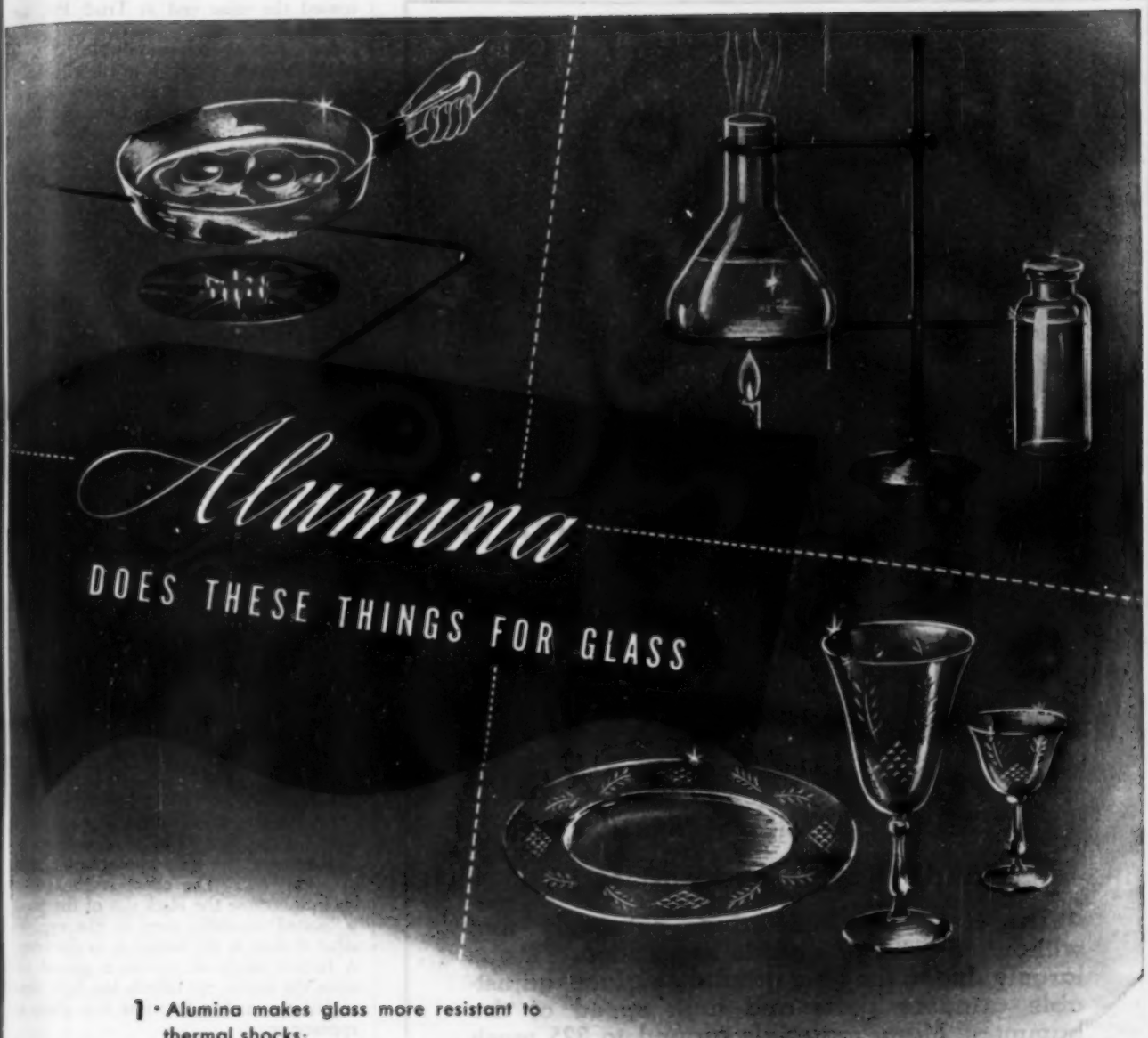
Appearance	White plate-like crystals with faint chlorous odor
Formula	$C_6H_7SO_2NClNa \cdot 3H_2O$
Molecular wt	240.6
Available Cl, %	29.47
Solubility:	
Water, percent at 20 deg. C	20
Alcohol and acetone	Soluble but decomposes
Ether, benzene, carbon tet., ethylene dichloride and most non-polar solvents	Insoluble
Compatibility:	
Most neutral and alkaline salts both in dry mixes and water solutions	Compatible
Acids, acid salts, ammonia, ammonium salts and reducing substances	Incompatible

SPRAY BOOTH COMPOUNDS

THREE compounds for keeping spray booths free of accumulated paint residues have recently been put on the market, two by Fidelity Chemical Products Corp., Newark, N. J., and one by Detrex Corp., Detroit, Mich.

The Detrex product, Triad PR, is a liquid which is sprayed or brushed onto the spray booth sidewalls while they are still clean. With this coating between the walls and the layer of overspray that normally builds up, quick and easy cleanup is facilitated. The booth so protected is stripped clean simply by spraying with water or steam, Triad PR and accumulated paint flushing off together. In dry booths which have no drainage facilities, the hard, white, dustless undercoating of Triad PR makes it much easier to scrape off the paint overlay.

The Fidelity products, while they work



1 · Alumina makes glass more resistant to thermal shocks;

2 · It increases mechanical strength, both crushing and tensile;

3 · Gives glass greater brilliance and luster;

4 · Increases fusibility;

5 · Makes a more elastic and ductile glass;

6 · Increases resistance to acids;

7 · Makes a glass of improved working properties;

8 · Decreases devitrification.

Alumina imparts many valuable properties to all types of glass, vitreous enamel, ceramics and refractories. Sample quantities of Alorco Alumina for experimental purposes are available to you. Write ALUMINUM COMPANY OF AMERICA (*Sales Agent for* ALUMINUM ORE COMPANY), 1910 Gulf Building, Pittsburgh 19, Pennsylvania.

ALUMINUM ORE COMPANY

ALORCO

Aluminas and Fluorides

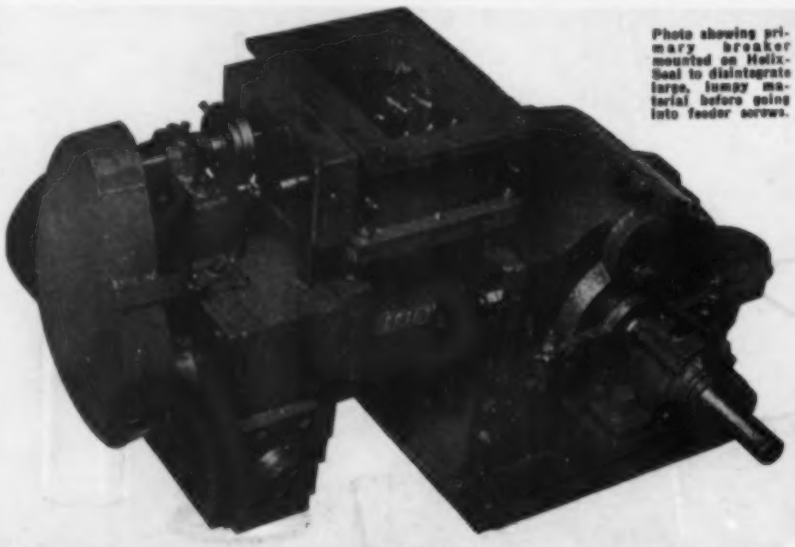


Photo showing primary breaker mounted on Helix-Seal to disintegrate large, lumpy material before going into feeder screws.

EASY AND INEXPENSIVE TO INSTALL AND OPERATE . . . .

THE WILLIAMS HELIX-SEAL PULVERIZER

FOR FINE GRINDING • • • 100 TO 325 MESH WITHOUT OUTSIDE SEPARATION

Grinds Wet or Sticky Material

• The Helix-Seal Mill grinds extremely fine without the aid of outside separation. This is largely due to the long grinding surface, adjustable grinding parts and high speed of the hammers. Many materials ground to 325 mesh and 100 to 200 mesh products are common on more difficult materials.

Due to the screw feeder which acts both as a feeder and seal, sealing the intake opening against the inrush of air, no air is sucked into the machine and consequently there is no resulting dust carrying draft expelled from the discharge. Built in nine standard sizes — capacities 200 pounds per hour and up.

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PATENT CRUSHERS GRINDERS SHREDDERS

toward the same end as Triad PR, are somewhat different in function and application. Fidelity compound No. 178 is added in small quantities to the circulated water, where it reduces the surface tension of the paint particles and insures their thorough wetting. This action, it is said, aids in throwing the particles from the air stream, prevents them from adhering to the metal surfaces of the system and from clogging pump and piping. It is also claimed that the compound is only mildly alkaline and does not have the corrosive effect of harsh caustics. Fidelity compound No. 229 is used on dry spray booths and surrounding areas which may be spattered by paint spray. It may be applied with spray gun, brush, or trowel and is said to remain moist for weeks. When desired, the coating and adhering paint may be removed with a trowel or scraper.

PLASTIC EYE

AN ALL-PLASTIC, artificial eye has been developed by the American Optical Co., Southbridge, Mass., which apparently is far superior to the well-known glass eye. Specifically, the new eye is said to provide greater durability, more life-like appearance, and greater comfort for the wearer.

While the average life of a glass eye is from six months to two years, a plastic eye is said to last for many years. Unlike glass, the acrylic resin of which the plastic eye is made produces an artificial eye which can be dropped without breaking, is not corroded by the eye socket secretions, and will not be broken by sudden temperature changes.

Life-like appearance of the new eye stems from the fact that its iris is reproduced by implanting in the eye a photographic print of a real iris. The effect is thus more realistic because the black dot of the pupil is located naturally, deep in the eye, instead of close to the surface as in glass eyes. A further touch of realism is gained because the plastic eye reflects less light than a glass eye, and is therefore less glassy in appearance.

Greater comfort for the wearer is claimed because the plastic eye can be reshaped by grinding to fit the eye socket. Moreover, the plastic is nonirritating to the socket's tissues, and it does not have to be removed at night, thus helping to maintain the shape of the eye socket.

MASKING TAPE

A NEW Koroseal tape for masking purposes in the plating industry has been introduced by the B. F. Goodrich Co., Akron, Ohio. It is known as Koroseal Tape MX, and is an adjunct to Koroseal Tape RX and Korolac RX, a solution of Koroseal already used in the plating industry. The new masking tape is said to possess good resistance to wear and abrasion, and to have excellent insulating properties. It is usable in practically all kinds of plating solutions, including chromic, alkali and acid dips. Any item which can be covered with ordinary friction tape can be masked by the new product.

To distinguish it from the older RX tape, which is made in glossy black, the new MX tape is given a gray color. It is supplied in ½, 2, 6, and 36-in. widths and a thickness of 0.005 in.

CHEMICAL ENGINEERING NEWS

SEIZED ALIEN PATENTS HAVE BEEN SUMMARIZED

AT THE outbreak of the war some 45,000 United States patents and patent applications were seized from enemy aliens and nationals of occupied countries. Licenses under most of these are now available to United States citizens for an administrative fee of $15 a patent.

As an aid to interested parties, the chemical patents and patent applications have been summarized and digested. The complete set of 8,000 chemical abstracts appropriately indexed is available for $25 through the Office of Alien Property Custodian, Chicago 3, Ill. In the same manner short descriptions and drawings of the 37,000 mechanical and electrical patents have been compiled in five volumes which are now available at $25 per set.

Copies of the actual patents may be seen at the Office of Alien Property Custodian, Field Bldg., Chicago; 120 Broadway, New York; 17 Court St., Boston; National Press Bldg., Washington; and Guardian Bldg., Portland, Ore.

NEW CONTRACT PLACED FOR CANADIAN ALUMINUM

IN THE latter part of March it was announced that Metals Reserve Co. had entered into a contract with Aluminum Union, Ltd., of Canada for the purchase of an additional amount of aluminum. The amount involved is reported at 250,000,000 lb. to be shipped from Canada in the latter half of this year. Prices are to be based on current sales prices of domestic producers with a base figure of 14 c. a lb. for metal with a purity of 90 percent or over.

Metals Reserve Co. may cancel the contract at any time after filing with the seller a 65-day notice of such intention. However, the buyer is obligated to accept delivery of a minimum of 100,000,000 lb. Provisions also are made whereby the seller may reduce the volume of shipments if unable to obtain sufficient bauxite or alumina at approximately the prices now prevailing.

WILLAMETTE ALCOHOL PLANT NEARS COMPLETION

CONSTRUCTION of one of the world's largest, and America's first, commercial plant for the production of ethyl alcohol from sawdust and waste wood by the Scholler-Tornesch method, has reached a point where it is expected to be in operation by July 1.

The $2,250,000 project occupies a 14-acre site at Springfield, Ore. It is the property of the Willamette Valley Wood Chemical Co. of Eugene, Ore., was formed by local lumbermen and financed through the Defense Plant Corp.

Smith Hinchman & Grylls of Detroit, the construction engineers who designed the plant, report that the railroad facilities are all in, most of the piling has been driven, foundations laid, main buildings erected, and underground pipe work installed. A 6,800-ft. sewer will carry away industrial waste. Construction is being supervised by Clark Van Fleet, project engineer of the Willamette company.

Shop details on the specialized percolation, fermenting, and distilling equipment have been completed by the Vulcan Copper & Supply Co. of Cincinnati, but some delays caused by shortages of critical materials have been experienced.

The laboratory of the Oregon State College at Corvallis, under Dean Paul M. Dunn, is cooperating in a study of the qualities, deterioration under storage, and availability of wood waste.

OHMITE LABORATORY FOR PRECISION MEASUREMENT

ANNOUNCEMENT has been made by Dr. Henry T. Heald, president of Illinois Institute of Technology, of an initial grant of $15,000 from the Ohmite Mfg. Co. to be used for the establishment of a laboratory for the precision measurement of electrical and magnetic quantities. The gift represents the initial contribution for equipping what will be known as the Ohmite Laboratory for Precision Measurements. It will be constantly expanded as new equipment becomes available. Its ultimate goal is to provide precision electrical measurements for the Chicago area approaching in accuracy those of the Bureau of Standards in Washington, D. C.

Working through the Armour Research Foundation, industries in the vicinity will have an opportunity to use the laboratory's facilities. This will be the first such laboratory in the Chicago area to make its services available to industry. In addition, the laboratory represents an important addition to Illinois Tech's electrical engineering equipment, by means of which graduate students can be trained in precision electrical measurements. It will further provide standards for research work carried on at the Foundation.

SUPREME COURT INVALIDATES GREBE-SANFORD PATENT

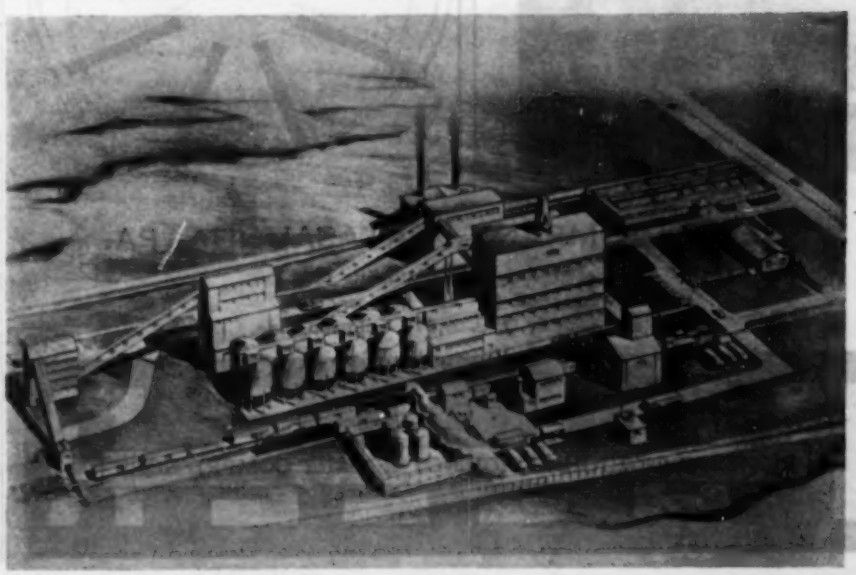
THE Supreme Court of the United States has handed down a decision unfavorable to the Dow Chemical Co. in its infringement suit against Halliburton Oil Well Cementing Co. The court concluded that the Grebe-Sanford patent is invalid for want of invention. This patent which was granted to Dow in 1932, relates to the treatment of deep wells such as oil, gas, brine, or water so as to increase their outputs. The patent covers the introduction of dilute hydrochloric acid into the well using an inhibitor to prevent the acid from attacking the casing or machinery.

OIL SHALE DEMONSTRATION PLANT FOR COLORADO

TO SERVE as a proving ground for new oil shale processing methods which might be economically feasible for private operators, a $1,500,000 oil shale demonstration plant will be built by the government near Rifle in western Colorado following selection of the site by Secretary of the Interior Harold L. Ickes.

The plant will be operated in conjunction with an oil shale research and development laboratory to be constructed at Laramie, Wyo., where shale cracking methods will be developed. Part of a

Architect's drawing of plant under construction at Springfield, Ore. Expected to begin production of ethyl alcohol from sawdust next July



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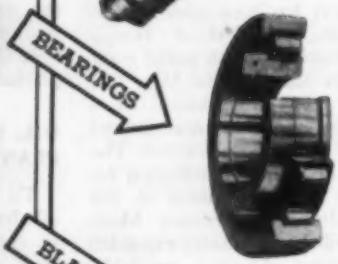
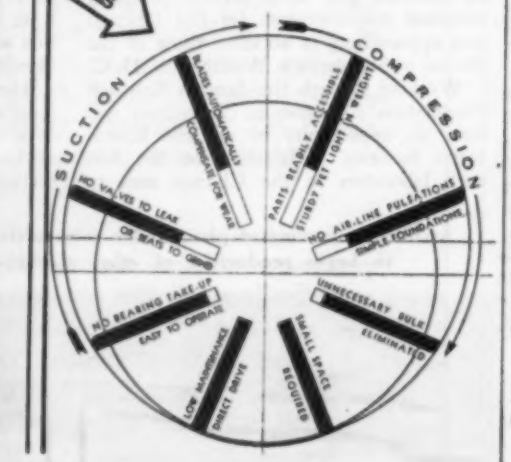
They show remarkable records of continuous performance and, after long gruelling service, if inspection and check-up is desired, the design permits of easy access with a minimum loss of time.

Write for Bulletin C-5.





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C-120

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PIONEERS OF HIGH-EFFICIENCY ROTARY COMPRESSORS

five-year synthetic liquid fuels program, the plant will include a 200-ton a day shale mine and crushing and retorting equipment. A shale oil refinery of pilot plant scale is scheduled to be added later.

LATEX PRODUCTION SPECIAL SYNTHETIC RUBBER

PRODUCTION of special synthetic rubber latex now exceeds one and one-half million pounds per month at one of the government's latex producing plants, operated for Rubber Reserve Co. by United States Rubber Co. at Naugatuck, Conn., according to J. P. Coe, general manager of the company's synthetic rubber division.

This liquid form of synthetic rubber replaces natural rubber latex where it was used in the manufacture of most synthetic rubber tires, and in fabric and paper impregnation. Nearly ten million pounds were produced last year at the Naugatuck plant and production by the end of this year is expected to reach two million pounds per month, dry weight. This compares with a nationwide consumption of natural rubber latex of six million pounds per month just before the war.

Peacetime uses of rubber in the form of latex include such highly developed products as surgeons' gloves and the winding of golf balls, where great strength, stretch, and resilience are required. Synthetic rubber latex does not have all of these particular properties in the same degree as natural rubber. But its properties are being continuously improved and it is highly essential in many military applications, including the solutioning of tire cord for both cotton and rayon tires of most military sizes.

MONSANTO WILL SELL DDT UNDER TRADE NAME

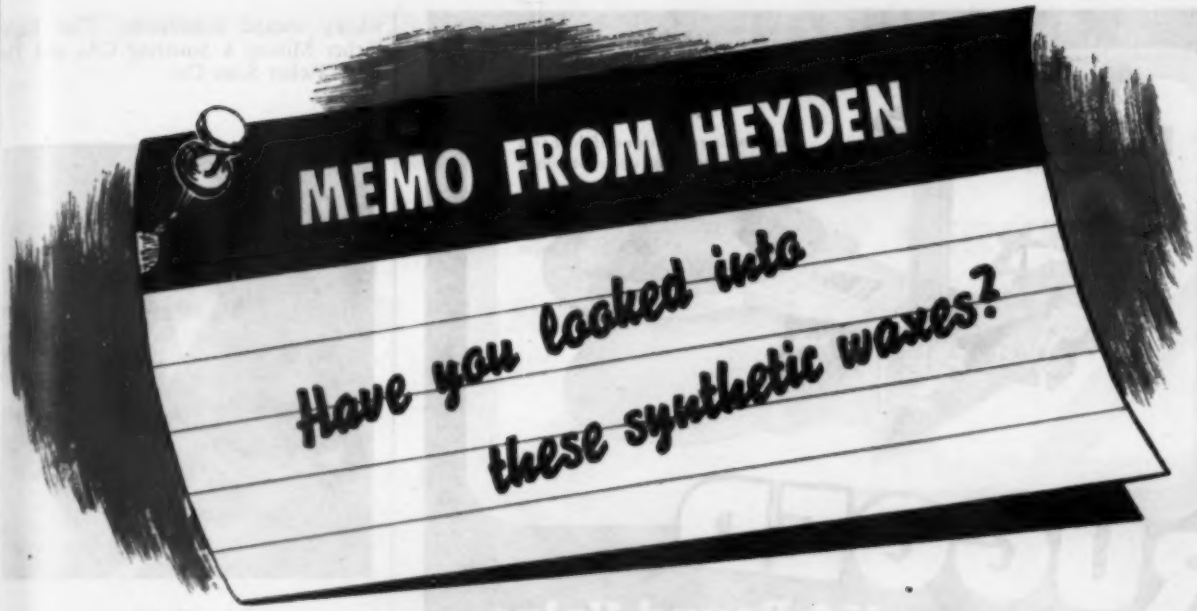
MONSANTO CHEMICAL CO. has announced that it will sell dichloro-diphenyl-trichloroethane, popularly known as DDT, under the trade name of Santobane. If formulations of Santobane are produced the same term will be used and with it an identifying letter or number. Monsanto now makes only the basic chemical, volume production of which was begun last September, with virtually the entire output going to meet military requirements.

EAGLE-PICHER CHANGES CORPORATE NAME

APPROVAL of a name change for The Eagle-Picher Lead Co. was voted on March 27 at the annual meeting of the shareholders of that company in Cincinnati. J. M. Bowlby, president, announced that the company is to be known as The Eagle-Picher Co.

The word "Lead" was dropped from the name because the management felt that it restricted the public concept of the scope of the company's activities. For many years Eagle-Picher has engaged in the manufacture and sale of numerous products that are not made of lead.

No transferrals of personnel are involved in the name change to The Eagle-Picher Co. Unaffected by the change are two



PENTAWAXES

The Pentawaxes are a series of synthetic waxes made from pentaerythritol and long chain fatty acids. Their physical properties are varied depending upon the degree of esterification and on the acids chosen. Because of this range of properties and other characteristics, these synthetic waxes prove valuable in many formulations. Listed below are some of the Pentawaxes available in commercial quantities.

PENTAWAX 145 is especially useful in forming emulsions of the water-in-oil type. The addition of a small amount of sodium stearate promotes the formation of gelatinous dispersions. Pentawax 145 is used in the cosmetic field in creams, salves, lotions, ointments and other products.

PENTAWAX 177 can be used as a replacement for Spermaceti in cosmetic preparations. It can also be used as an oil-resistant coating for paper. Pentawax 177 shows good compatability with linseed oil and therefore may be used to advantage in printing inks as a rub-preventing material.

PENTAWAX 217-F is useful in the manufacture of various types of polishes such as furniture, floor, and shoe polish, saddle soap, leather and automobile polish. When used with Paraffin Pentawax 217-F raises the melting point and can therefore be used to advantage in candles.

PENTAWAX 217-N. The resistance of this synthetic wax to corn oil, mineral oil, ethanol, and water promotes its use as a coating material for shipping containers. Pentawax 217-N can also be used as a partial replacement for carnauba wax in self-polishing or dry-bright types of floor polishes. Another suggested use is as an effective antifoam agent when added to water-miscible oils used in the manufacture of paints.

PENTAWAX 286. An important property of this wax is its ability to form gels at approximately 5% solids concentration in aliphatic hydrocarbon solvents. This makes it very useful in paste waxes such as shoe polishes and saddle soaps, as well as in floor, furniture and automobile polishes. Pentawax 286 can also be used to advantage in tumble-polishing of buttons. In general, the properties of this wax suggest its employment in lubricating compositions, paints, varnishes and lacquers, printing and lithographing inks, and other applications which require a wax of moderate toughness. Due to its excellent resistance it can be used to coat papers or cardboard containers and packages.

Write for samples and further information

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Benzaldehyde • Benzoates • Benzoic Acid • Benzyl Chloride • Bromides • Chlorinated Aromatics • Medicinal Creosotes • Formates • Formaldehyde • Formic Acid • Glycerophosphates • Medicinal Guaiacols • Monomethylaniline • Paraformaldehyde • Paranitrophenol • Penicillin • Pentaerythritols • Salicylates

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150-Pound Valve

Better Built Than 300-pound Steel Standard

Designed for high temperature gases, heavy chemicals, catalysts and high octane gasoline operations, this R-S 150-pound All-Steel Butterfly Valve, with the exception of the 150-pound raised face flanges, is actually better built than a 300-pound steel standard. Body, vane, shafts, keys, bushings and bearings far exceed 150-pound ASA requirements. Outlasts 150-pound pipe fittings.

Equipment consists of a 300-pound hydraulic cylinder with zero to 15 psi positioner, heavy-duty hand wheel, self-locking worm and gear and declutching unit.

A paramount feature of all R-S Butterfly Valves is the fact that the flow "fans out" into a crescent-shaped spray when the vane approaches a closed position. Wear is not confined to one small surface with a consequent weakening of the valve wall when abrasive materials are handled.

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60-inch valve with finned stuffing box, chain wheel operated.

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R-S Streamlined BUTTERFLY VALVES

wholly owned subsidiaries, The Eagle Picher Mining & Smelting Co., and The Eagle-Picher Sales Co.

John C. Olsen

Reproduced above is a photograph of the portrait of Dr. John C. Olsen which was presented to Brooklyn Polytechnic Institute by his associates, friends and students. Portrait was painted by Wilford Seymour Conrow (class of '96) and presentation was made April 7 at a dinner honoring Dr. Olsen, Professor Emeritus of Chemical Engineering, for his long service to the Institute, in commemoration of his seventy-fifth year, and for his services to the chemical engineering profession.

HERCULES POWDER REELECTS OFFICERS AND DIRECTORS

Directors of Hercules Powder Co. at their annual organization meeting held on March 28 reelected all officers of the company as follows: Charles A. Higgins, president and chairman of the board; Leavitt N. Bent, Petrus W. Meyeringh, Edward B. Morrow, Anson B. Nixon, and Philip B. Stull, vice presidents; Raymond N. McAdams, secretary; and Francis J. Kennerley, treasurer.

The directors also reelected the executive committees, Messrs. Higgins, chairman; Bent, Meyeringh, Morrow and Nixon.

ALCOHOL PRODUCTION BEGUN AT BELLINGHAM PLANT

First manufacture of ethyl alcohol from sulphite pulp liquor in the United States was under way recently when Puget Sound Pulp & Paper Co. began operating its $1,000,000 plant at Bellingham, Wash. at 40 percent capacity. Entire output goes to the government for making synthetic rubber and ammunition.

When in full operation, the plant, with a sulphite pulp capacity of about 400 tons per day, will be producing 5,500 gal. of 190-proof alcohol per day by fermenting the sugar content of the waste liquors. It is believed the success of this

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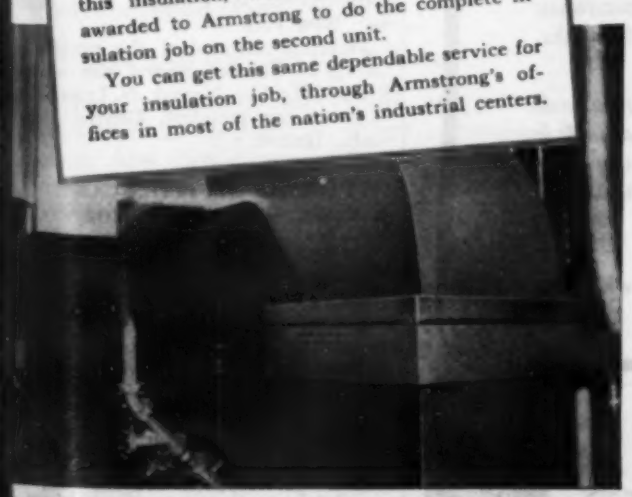
O. K. from F. W. to I. D.

From feed water lines to induced draft exhaust gas ducts, all piping and equipment in the first unit of a giant electric power plant in the East were insulated a year ago by Armstrong's Contract Service.

So satisfactory has been the performance of this insulation, that contracts were recently awarded to Armstrong to do the complete insulation job on the second unit.

You can get this same dependable service for your insulation job, through Armstrong's offices in most of the nation's industrial centers.



SHOWN ABOVE is the 19th stage heater covered with 1½" magnesia and ½" cement (hard finish). Left, section of primary air duct with expansion joints covered with 1½" high-temperature insulation, 1" magnesia block, and ½" asbestos (hard finish).

ENGINEERING "KNOW-HOW"—applied to the *complete* job—is one of the big advantages you gain when you use Armstrong's Heat Insulation Contract Service. With Armstrong engineers on your job, you get the benefit of years of experience in planning the application and erection of insulation. In addition, Armstrong's complete service provides materials of tested efficiency and skilled workmen to install them. The Armstrong organization takes full responsibility for every phase of the work—planning, supervision, materials, and workmanship—thus assuring that every detail is *right*. For complete information, write today to Armstrong Cork Co., Building Materials Division, 3304 Concord St., Lancaster, Pa.

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Complete Contract Service For All Temperatures

From 300° Below Zero

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Stainless Steel trough polished to high finish to assure thorough cleaning and prevent contamination.

HOW PROPER **FINISH** LOWERS MAINTENANCE COSTS IN YOUR PROCESSING EQUIPMENT

● Ease of cleaning can be built into your processing equipment by polishing to the degree best suited to your application. To reduce minute surface imperfections in the stainless steel sheets used in building your vessels, we employ specially designed polishing machinery. This operation helps minimize adhesion of materials to the surfaces of your equipment. It means that your equipment will be more quickly and more thoroughly cleaned. It means lower operating and maintenance costs, fewer man hours for cleaning, less shutdown time. It is added assurance that contamination will be more easily avoided in the tanks, kettles, and other vessels we make for you.

Finish control through the use of special machinery is just one more way in which S. Blickman guards alloys in fabrication. It is just one more of the tested procedures which have proven effective in building equipment that operates more economically for you. For your next job, consult with us.

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CORROSION RESISTANT PROCESSING EQUIPMENT

TANKS • KETTLES • STILLS • HEAT EXCHANGERS • AGITATORS • MIXERS • TOWERS • PIPING

plant may help solve the huge industrial waste disposal problem created by liquors from sulphite pulp mills.

First ethyl alcohol plant using sulphite pulp in the Western Hemisphere is located at Thorold, Ontario, where manufacture was begun over a year ago. The Bellingham plant, of which E. Ekholm is general superintendent, is the second in this hemisphere.

LONDON CHEMICAL CLUB WELCOMES KIRKPATRICK

As a welcome to Sidney D. Kirkpatrick who is now in England on a special government mission, members of the Chemical Club of London held a soiree and cocktail buffet at the club on the evening of April 5. The invitation cards read "to meet Mr. Sidney Kirkpatrick, editor of *Chem. & Met.* and some other members of the Technical Industrial Intelligence Committee which is led by Mr. Kirkpatrick. He is the London representative of the U. S. Chemicals Bureau of the War Production Board, president of the Electrochemical Society, Inc., a past-president of the American Institute of Chemical Engineers and a director of the Mc-Graw-Hill Book Co."

FIRE EXTINGUISHER GROUP ELECTS OFFICERS

The Chemical Fire Extinguisher Association, at its annual meeting held in Chicago last month reelected the following officers: president, Arthur G. Sullivan, vice president, Buffalo Fire Appliance Corp., Buffalo, N. Y.; vice president, J. O. Binford, general sales manager, American-La France-Foamite Corp., Elmira, N. Y.; treasurer, Herman W. Diener, secretary, George W. Diener Mfg. Co., Chicago; and commissioner, W. J. Parker, W. J. Parker, Inc., New York.

Directors reelected at the meeting are George H. Boucher, general sales manager, Pyrene Mfg. Co., Newark, N. J.; and E. A. Warren, vice president, General Detroit Corp., Detroit.

BUTADIENE SUPPLIES CAME LARGELY FROM ALCOHOL

Approximately 64 percent of the butadiene produced last year for military and essential civilian rubber requirements was made by the alcohol process developed by Carbide and Carbon Chemicals Corp., the company revealed in announcing 1944 production figures. Plants using Carbide's process operated at over 164 percent rated capacity last year to attain a record production of 361,000 tons of butadiene.

The government's original plan for producing synthetic rubber provided that about one-third of the required butadiene would be made in plants employing the alcohol process pioneered by Carbide and Carbon Chemical Corp. In 1943, the first year of operation, the alcohol-process plants produced over 75 percent of all the butadiene made for GR-S rubber. The 1944 production record of 64 percent of all the butadiene produced in the country was made despite the fact that good progress had been made in the production of butadiene by other processes.

THE PAST FORETELLS THE FUTURE

Your copy of this fine book is now ready. You will want it as a guide for the future.

The best guide for your future relations with a man is his reputation in the past.

So it is with business institutions.

Today, more than ever before, every individual business must depend on other individual businesses. And that dependence can, and should, be placed only upon those business institutions whose record of performance as to policy, product, service and general attitude has been flawless in the past.

Many new businesses exist today. Many others, old in years, have not kept young in thinking . . . and are passing from the national picture. This has been the history of business since the world began.

Yet, through all the economic changes, certain institutions have grown old in years, but have kept young in spirit and have constantly improved upon their original reason for existence.

The book illustrated above deals with the history of The Falk Corporation, its ideals, accomplishments, and plans for the future so far as those plans can now be projected.

You, too, in your effort to render a service to your industry, must of necessity have followed many of the principles set forth in this book. For that reason we believe that the book will interest you and will provide you with reasons why The Falk Corporation will be a sound source of supply for the machinery you will need to shave pennies from production costs and improve your product, in order to compete in the salesmen's war to come.

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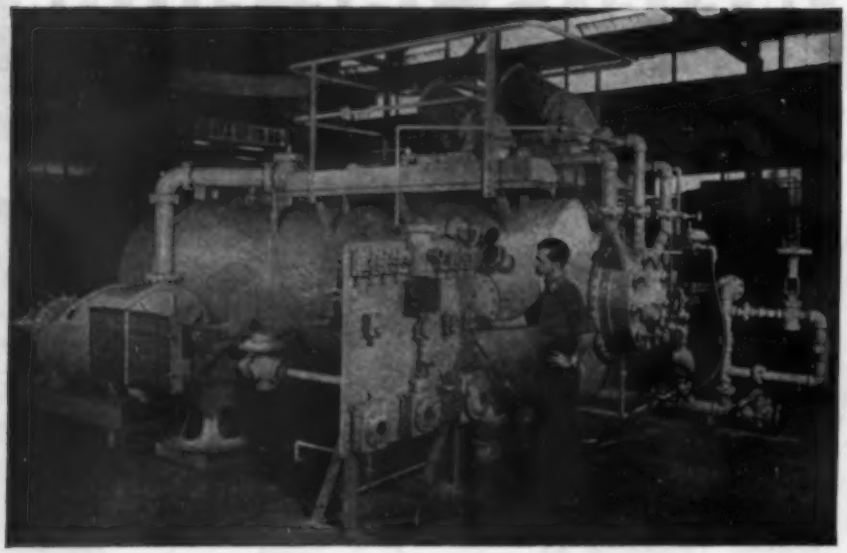

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Available in standard models in capacities ranging from 1,000 to 100,000 CFH—**larger sizes and special models built to order.** All models feature:

(1) **Flexibility**—gas production automatically responds to demand at any rate up to 100% of capacity—thus frequently eliminating need for gas holders to handle peak loads.

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CARBON BLACK PRODUCTION TO BE INCREASED

Although production of carbon black has been expanded, it has not kept pace with the sharp rise in output of synthetic rubber and the pushing up of tire requirements. The shortage of black in the grades used in synthetic rubber has caused government agencies to survey every possibility whereby production might be brought up to the required level. The latest action to stimulate production was taken by the Office of Price Administration which authorized higher prices for all the rubber grades. The price increases are variable depending on variations in production costs under the emergency use of different raw materials and other factors which add to the usual cost of operations.

The announcement of new ceilings for carbon black followed an earlier report on the steps being taken to bring about larger outputs. These included a curtailment of exports, the utilization of propane gas, naphtha, and gasoline residue, and the establishment of carbon black manufacture in California, the mid-continent area, and Canada where sweet gas might be used.

WPB also approved and granted AA-1 preference ratings to new projects and additions to existing plants which carry an estimated cost of $11,372,000 and an estimated productive capacity of more than 181,000,000 lb. These projects include: Cabot Carbon Co., Guymon, Okla., $262,000; Borger, Tex., $801,666; McCoy, La., $1,040,000; Wickett, Tex., $150,000.

Cities Service Oil Co., Ector County, Tex., $224,000; North Cowden, Tex., $150,000.

Columbian Carbon Co., Seagraves, Tex., $55,595.

J. M. Huber, Inc., Borger, Tex., $212,400.

Jefferson Lake Sulphur Co., Clemens, Tex., $360,454.

Charles Eneu Johnson, Eunice, N. Mex., $2,825,000; Monument, N. Mex., $410,000.

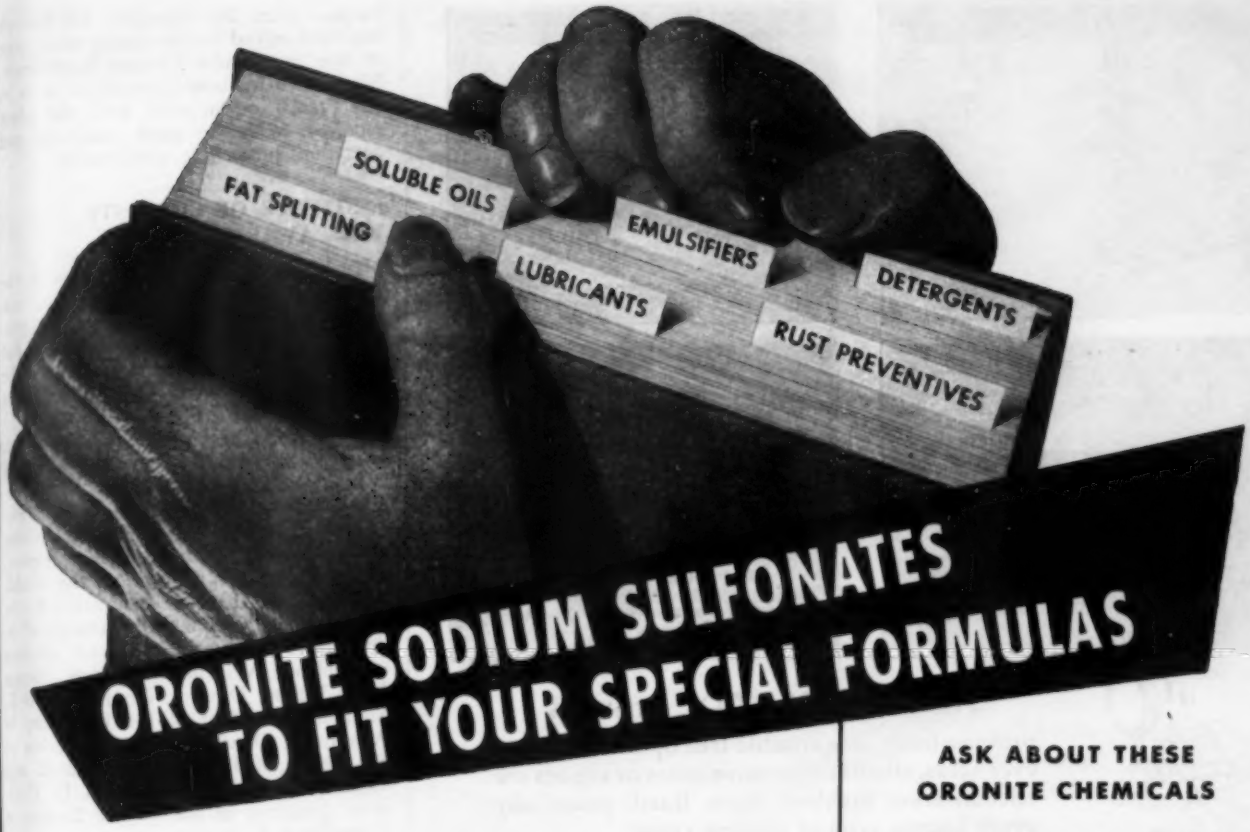
Phillips Petroleum Co., Borger, Tex., $379,810; Goldsmith, Tex., $53,000; Eunice, N. Mex., $142,826.

Roxboro Steel Co., Hardin, Tex., $250,000.

United Carbon Co., Ryus, Kans., $1,105,748; Ryus, Kans., $1,248,420; Ector County, Tex., $158,621; Foster Field, Tex., $139,000; Midland, Tex., $28,755; Odessa, Tex., $1,135,200; and Judkins Co., Tex., $139,475.

BLAW-KNOX CONTINUES TO OPERATE FRENCH PLANT

Formed in 1928 as a subsidiary of the Blaw-Knox Co. of Pittsburgh, the Compagnie Francaise Blaw-Knox has been engaged in turning out machinery and steel products ever since at Chauny, Aisne, France. Nicholas Gerten, who joined the Blaw-Knox company in 1927, was acting as managing director of the French plant in 1939 and 1940. When the Germans overran France in 1940, he was forced to leave his post and returned to the company's headquarters in Pitts-



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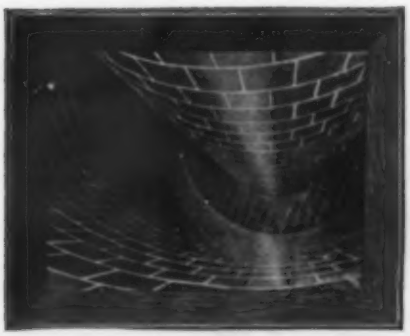

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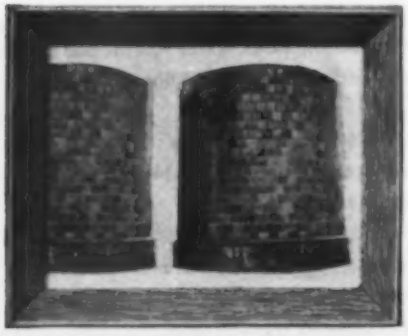

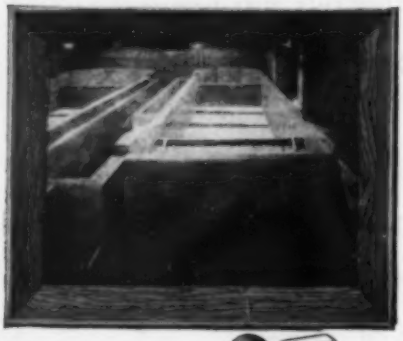

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burgh. After his departure, his French associates carried on the management, part of the time under German supervision. Mr. Gerten has now resumed his work in the French organization with the plant reported to be in good condition and operations proceeding satisfactorily.

INSTITUTE OF CHEMISTS WILL AWARD MEDAL

IN COMPLIANCE with the wishes of the Office of Defense Transportation, the American Institute of Chemists has cancelled its scheduled annual meeting but the gold medal of the Institute will be awarded by the Miami Valley Chapter at its regular meeting to be held on May 11 in the Hotel Deshler Wallick, Columbus, Ohio. The 1945 recipient of the medal is John W. Thomas, chairman of the Firestone Tire and Rubber Co., whose lifetime in chemistry was capped by his contribution to the synthetic rubber program. Dr. Gustav Egloff will present the medal.

Dr. E. L. Luaces, chairman of the Miami Valley Chapter, is in charge of arrangements for the meeting and speakers will include William M. Jeffers, former U. S. Rubber Director; Dr. Hezzleton E. Simmons, president of the University of Akron; Dr. Donald B. Keyes, director of the Office of Production, Research and Development, WPB; and John D. Coleman, president of the Dayton Society of Professional Engineers.

VANADIUM PRODUCTION RESUMED IN UTAH

REOPENING of the $1,200,000 Defense Plant Corp. vanadium mill at Monticello, Utah, by Vanadium Corp. of America, which shut down operations about a year ago when reserves were considered sufficient, was effected early last March. A stockpile of ore at Monticello, purchased by Vanadium Corp., which leased plant facilities from Defense Plant Corp., is expected to last a year, according to A. A. Sproul, general superintendent. Vanadium again is on the critical list.

Monticello operations include mixing carnotite-bearing ores (about 1.8 percent V_2O_5) with pyrite, drying to 3 percent moisture, mixing with salt, roasting, leaching with a soda ash solution, precipitating V_2O_5 with sulphuric acid and finally fusing the precipitate.

NATIONAL RESEARCH CORP. SPONSORS FELLOWSHIP

THE National Research Corp. of Boston has established a graduate fellowship at the Massachusetts Institute of Technology. The fellowship has been founded with the hope that it will foster interest in, and the development of new processes performed under high vacuum in the fields of chemistry, physics, metallurgy, chemical and mechanical engineering. The corporation also announced that the fellowship is a tangible expression of the company's opinion that American industry has a definite responsibility to the universities for the encouragement of fundamental research. The initial grant will be $2,500.

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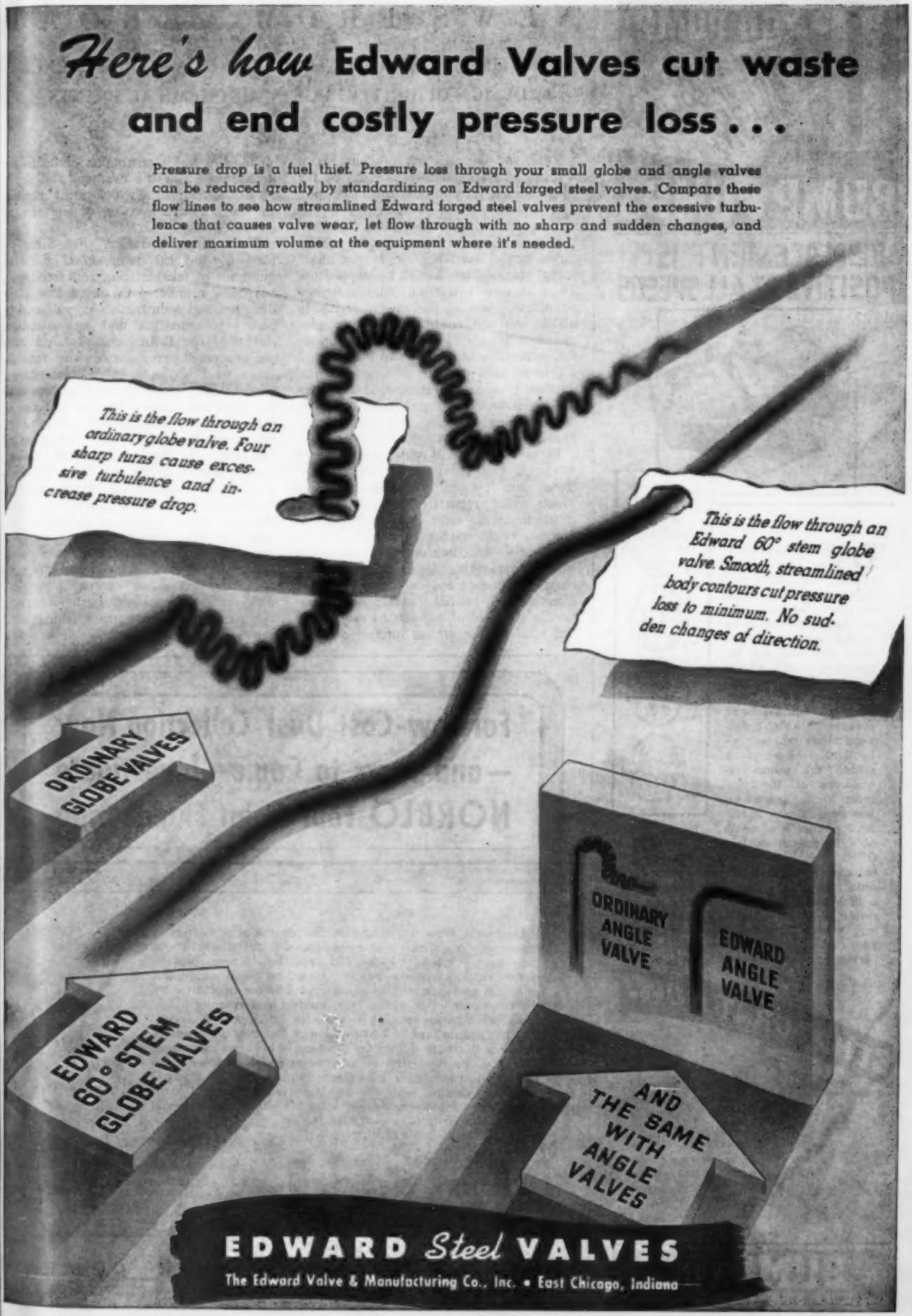
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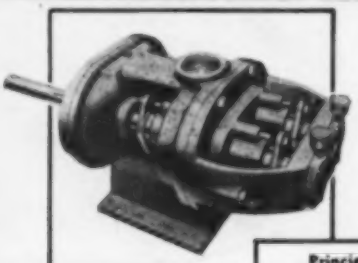

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NEWS FROM ABROAD

WARTIME PRODUCTION EXPERIENCE WILL INFLUENCE DESIGN OF BRITISH POSTWAR CHEMICAL PLANTS

Special Correspondence

IT IS NOT perhaps as surprising as it seems that commodities affected by the relaxation of wartime control made possible by certain readjustments in armament production are just those "critical" raw materials which caused most anxiety earlier in the war when the output of essential commodities had to be stepped up. Then as now non-ferrous metals figured prominently among the raw materials to which wartime controllers had to give special attention. That this is so proves the general success of wartime control which made it possible to speed up production to such an extent that all essential needs were met, and now to reduce output figures to less ambitious proportions.

From the point of view of the metal producer, this cut-down in official purchases has created particular problems which have necessitated suitable specific arrangements to avert social and financial dislocation. From the point of view of the normal peacetime consumer, however, who has had to cut down his metal purchases because of the overriding needs of essential and priority buyers, the relaxation in the field of non-ferrous metal control is of all the greater interest as these engineering and construction materials are indispensable for the overhaul and repair of neglected plants which must precede any large-scale conversion of industry to civilian orders.

No wonder, therefore, that these relaxations and the prominence given to questions of rehabilitation and reconstruction have stimulated the interest of plant designers and industrialists in problems of plant modernization and rationalization. As far as the British chemical industries are concerned, much repair and rehabilitation work which, in other circumstances would have been regarded as essential, has been left undone because the aim of expansion of production left no construction capacity available for renovation of old plants. In the latter part of the war many branches of the British chemical industry were handicapped by the existence of old and, in some parts, obsolete plants and new factories built as quickly as possible to meet specific wartime requirements. Neither are ideal from a technical or economic point of view, and the costs of production often vary a great deal, necessitating special pay arrangements on the part of the authorities which often found the cost plus percentage profit system

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Dust and fume collection in the chemical industries is admittedly a difficult and complicated problem which was only partly solved by the old type bag house. Norblo automatic bag type equipment is based on the air expansion principle and adapted to continuous 24-hour operation by the development of cyclic bag shaking and cleaning. Dust is collected at lowest cost because the efficiency of separation per square foot of bag and hence the over-all capacity does not fluctuate during the short cycle between cleanings.

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most suitable, or rather least troublesome, method of buying industrial products. Now that the moment has come to reduce output figures the authorities will try to cut down first on the less economically working factories, though such a policy based exclusively on financial considerations must be modified in the light of social and military considerations.

In any case, there are a number of difficult problems which are bound to arise as soon as any kind of discrimination between different factories and suppliers is practised. The factories released from essential production will be the first to be converted to civilian needs, and though the recent call-up of surplus industrial workers for the armed services prevents any large-scale and general transfer of plant capacity, it stands to reason that if the higher-cost producers are released first and converted to civilian production the cost of such non-essential products will be comparatively high.

More efficient firms retained on essential work may well think that they have a genuine grievance in such conditions, and the differential treatment may easily provoke difficulties which will still be felt long after the war. Is then the conversion to civilian needs to be delayed? Or are some of the more efficient producers to be allowed to devote part of their plant to such non-essential work? Can the disadvantages thereby created for essential production be accepted without detriment to the war effort? These are important questions which will sooner or later have to be answered.

SCRAPPED PLANTS

In any case it is thought that while a large part of wartime plants can be usefully converted to peacetime needs much of the existing capacity will probably have to be scrapped and replaced by modern machinery designed and constructed with an eye to future needs. Seen from this angle, chemical manufacturers are not sorry that wartime conditions prevented modernization and repair of old plants, which in any case would be of doubtful value and hardly repay the money spent to overhaul it. The planning which is now carried out by private firms on the one hand and government agencies and research stations on the other envisages a fair amount of new plant construction even though it may be sited with reference to war factories. Great experience in industrial production methods, in modern design and construction, in labor and fuel saving arrangement of the flow of production has been accumulated during the war, and this still waits for practical utilization for peacetime needs.

This new knowledge of efficacious plant design and output arrangement will not only greatly influence chemical plant manufacturers but also some sections of the chemical industry itself. Outside the British Isles it is hardly realized how profound these changes are likely to be. There are, for instance, quite a number of investigations afoot all of which have the purpose of exploring the most advantageous arrangement of production for whole industries. In the coal utilizing industries, for instance, several committees appointed by the Minister of Fuel and Power are

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engaged on postwar planning. Another committee is inquiring into the organization of the gas industry. Possibilities of utilizing hydro-electric power have been and are still being examined. The chemical processes for coal utilization are the subject of continuous experimentation at various universities and research stations.

In the meantime some prospective large-scale consumers of coal and tar derivatives have given some idea of the quantities of various products they are likely to require after the war. Starting from these figures, it has been suggested that other consumers of organic chemicals should try to specify their probable needs because the scanty statistical information available at present indicates that both the magnitude and the composition of this postwar demand will be greatly different from present or previous conditions. In the first place, it seems certain that coke will be accepted on a greatly increased scale as a household and boiler fuel. As a result there should be a considerable expansion in the production of gas, and this may necessitate a reorganization of the coke-oven and gasworks industry.

COKE BYPRODUCTS

The increased production of coke and consequent rise in the output of byproducts will make economic use of distilling and other refinery plants possible where this was hitherto not the case. Further, it is expected that much larger quanities of benzol and naphthalene will be needed, not only in England but in other countries as well, an opportunity from which British producers as exporters of long standing should try to make good use. Moreover, it is thought that road construction, during wartime restricted to the absolute minimum, will provide an outlet for some previously neglected heavy coal-tar products if they can be made competitive with bitumen.

The extent of the postwar demand for organic chemicals and the intermediates from which they are made cannot of course at present be estimated with any degree of certainty. Whatever work is done on these matters now must therefore be tentative. New outlets and new methods of production constantly change the situation. But even so one point is certain, that the British manufacturers of coal derivatives must be able to sell their products at competitive prices. In the past there have been frequent and wide fluctuations in the prices of organic chemicals in the British market. These have upset production to a certain extent, and while they tended to stimulate byproduct utilization in general they resulted in some curious cases of neglect and oversight of valuable derivatives for which there happened to be no actual demand at satisfactory prices. It is hoped to avoid such incongruities by systematic development and exploration of all outlets.

It so happens that the products required by some of the more "modern" customers of the carbonizing industry, like the plastic trade, can also be supplied, or substituted by the petroleum industry, and some work, as that for the extraction of ethylene at coke-oven plants, is carried out with a view to the replacement of the imported petroleum-based article. Obvi-

IN THE BYRON JACKSON PNEUMATIC SPONGE

THE SIMPLE 'CIRCLE S' RUNNER REDUCES WEAR— PREVENTS CLOGGING

Here's how

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This two port impeller design, first of all, permits the easy passage through the pump, to the discharge port, of any spherical solid able to enter the eye or suction intake of the pump. Second, the curved vanes of the runner are so designed that sand, gravel and other abrasives, carried in suspension in the pumped fluid, do not directly impinge upon any one section of the runner, or pump case. Instead, easy, natural flow lines are followed from entrance to discharge ports, thereby minimizing possible wear.

Rugged, compact, yet light in weight (85 pounds), the Byron Jackson Pneumatic Sponge is suitable for operation in any position. Designed for pumping heads up to 150' in single stage and 300' in two stages, solids 9/16" in diameter may be handled in the 2-1/2" size and 1-1/8" through the 3" size. The Rotary air motor operates on compressed air at pressures from 70 to 100 psi. Write today for Pneumatic Sponge Bulletin.

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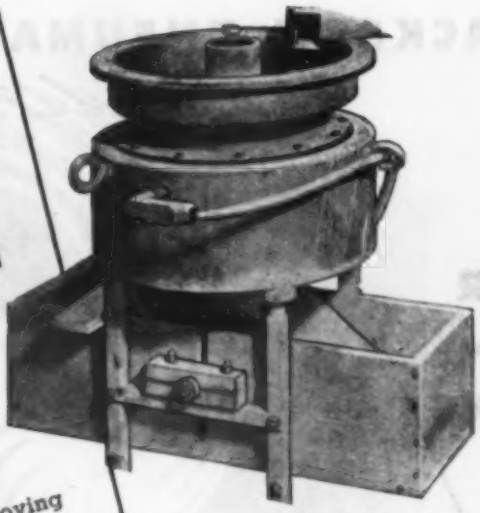
How to Remove Iron From Liquids



Dings Wet Type Separators provide the most effective method yet devised for removing iron from ceramic slip and glaze, inks, foods, paper pulp, oil, cutting compounds, etc. These High Intensity units are the result of nearly 50 years of specialization in the manufacture of magnetic separators. Send today for factual, illustrated bulletins.

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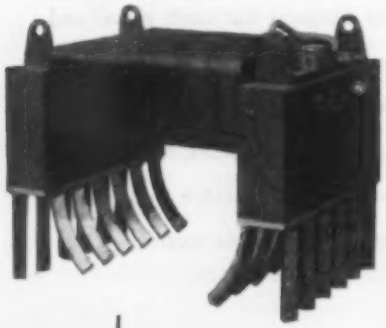

Dings Type T Separator

Effectively removes iron particles when unit is lowered into any tank or spout. Easily cleaned by withdrawing separator from solution, interrupting the current and allowing accumulated iron to discharge.

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ously all these developments will have a profound bearing on plant design and construction. The coal utilizing industry in particular will require large replacements and renovations, and the authorities are fully aware of the important bearing these developments have on the well being of the coal industry, the most important of the country's basic industries.

Another example from the chemical trades of quite a different aspect of the same problem is provided by the paint industry which before the war covered the whole of the home market and sold considerable quantities abroad, but had to curtail its civilian sales greatly during the war, and faces a substantially expanded demand after the war when new technical conditions will require different types of paints. If building attains the level of construction projected by government agencies, the new methods to be used will demand novel types of quick-drying paints lending themselves to mechanical application. New solvents will be needed, and new plants will be required to provide the large quantities involved.

No details of the type of plant envisaged have as yet been given, but it is clear that in this and in other sections of the chemical industry the greatly inflated postwar requirements will be met only by use of mechanical means of production which demand new types of machinery and plant. These must be supplied before any large-scale production can be started. Naturally British manufacturers have been greatly intrigued by the comparative ease with which the problem of output expansion has been tackled and solved in the United States, and it is thought in wide circles that the solution of Britain's problems must be sought on similar lines.

FINLAND'S RAYON PLANTS INCREASE OUTPUTS

FINLAND'S first rayon plant was located on the Karelian Isthmus but was lost to the country when that area was ceded to Russia. In February 1941 it was decided to establish a new plant at Valkeakoski. Production of staple fiber was begun in the fall of 1943 and of rayon in September 1944. At the end of January 1945 the viscose plant, staple-fiber spinnery, rayon spinnery, carding plant, power station, and repair shops were in operation. When all the machinery is installed it will have a daily capacity of 20,000 kg. of rayon and 700 kg. of staple fiber.

A new firm organized last December was scheduled to begin construction this spring of a rayon plant at Kokkola. Production will be confined to yarn with an annual capacity of 1,825,000 kg.

AUSTRALIA WILL PRODUCE FATTY ALCOHOLS

THE Victorian Chemical Co., Pty., Ltd., Australia, in 1935 under an agreement with Bohme Fettchemie of Chemnitz, Germany, formed a subsidiary to produce fatty alcohols from German raw materials. In 1939 this subsidiary, the Sardinol Chemical Co., was liquidated. The Victorian Chemical Co. has utilized the experience gained by operating the subsidiary to operate independently on a small scale

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Cylinders, Arresting Engine and Elevator
Cylinders, Creosoting
Cylinders, Steering Engine
Deck Auxiliary Equipment
Deodorizers, (Edible Oils)
Devulcanizers, Rubber
Die Blocks
Digesters, Pulp and Paper, Stationary and Rotary
Distillation and Extraction Equipment
Dryers, Rotary, Direct and Indirect Heat
Dryers, Drum
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Exchangers, Heat
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Furnaces, Rotary Drying and Carbonizing
Gun Forgings
Hammer Rams
Heat Exchangers
Heaters, Air, Gas, Liquid
Heaters, High Pressure Feed Water
Heaters, Suction for Oil Storage Tanks
Impregnating Equipment
Kneading Machines
Kettles, Plain or Jacketed, All Types, With or Without Agitators
Kettles, Food Cooking
Kettles, Grease and Oil Blending
Kettles, Lead Melting
Kilns, Lime
Kilns, Rotary
Mats
Mixing Equipment, Steel and Alloy Steel
Mixers, Electrically Heated
Mixers, Revolving Drum
Mixers, Vacuum and Pressure
Nitrators
Oil Coolers
Oil Country Boilers
Oil Country Gas and Oil Engines
Ordnance, Compounds
Pans, Crystallizing, Drying, Evaporating, Etc.
Pipe, Corrosion Resisting Alloy
Pipe Moulds, Finished Machined
Pipe, Steam Jacketed
Piston Rods Rough or Finished Machined
Plungers
Preheaters
Pressure Vessels, Electric Fusion Welded, or Forged to All Code Requirements
Pulp and Paper Mill Equipment
Quick-Opening Doors
Rayon and Viscose Equipment
Rectifying Columns
Refinery Equipment, Petroleum
Refining Equipment, Vegetable Oils
Retorts, Food Cooking
Retorts, Wood Distillation
Rolls Rough or Finished Machined
Shafting, Forged, Rough and Finished Machined
Ship Forgings
Soap Crutchers and Kettles
Solvent Recovery Plants
Spars
Stainless Steel Tanks and Equipment
Steam Generators
Fire Tube
Water Tube
Steering Gears
Stills, Steel and Corrosion Resisting Alloys
Tangent Benders
Tanks, Steel and Corrosion Resisting Alloys
Turpentine and Rosin Extraction and Refining Equipment
Valves, Special Forged Steel
Vulcanizers
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2. High output
3. Required pressure
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TYPE S SLURRY PUMP

Used exclusively for handling black liquors, Morris Slurry Pumps consistently outlast and outperform lighter pumps in pulp mills all over the country. Designed for uniform delivery of highly viscous liquors at high temperatures, they maintain their efficiency over consistently longer periods . . . with marked freedom from clogging, corrosion and packing difficulties.

Built to Last

Morris Slurry Pumps have more metal where metal counts most. Designed for moderate speeds, they keep vibration and abrasive wear at a low point. The pumps are capable of operating against high heads caused by high pipe friction losses and often high terminal pressure. The parts in contact with the liquor are furnished either in nickel iron, Ni-resist or stainless steel, depending upon the abrasive or corrosive properties of the liquor.

Write for special "Slurry Pump" bulletin. Find out how Morris Pumps will give you longer life and more satisfactory service per pumping dollar.

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MORRIS CENTRIFUGAL PUMPS

using raw materials from the United Sta and the United Kingdom. Research h been carried out and the company no plans to turn out sulphonated fatty alcoho from domestic raw materials.

SURINAM CURTAILS MINING OF BAUXITE

A REPORT to the Department of Co merce from our consulate at Paramari states that only three United States ves arrived in Surinam during February to loa bauxite, most of the carrying trade hav passed to ships under the Dutch, No wegian, and Panamanian flags. The Bil ton Mining Co. is expected to close it Smalkaldon plant for an indefinite peri since the Metals Reserve Co. has not re newed its contract for the purchase o bauxite.

BOLIVIA HAS NEW VEGETABLE OIL PLANT AND REFINERY

A NEW plant for the production and r fining of vegetable oils has started ope ations at La Paz, Bolivia. It has an est mated capacity of 100 metric tons o refined oil per month and is concerne principally with processing linseed and sun flower seeds. To stimulate oilseed produc tion, large quantities of sunflower seed have been distributed to land proprietors i the vicinity of La Paz in order to give th plant an ample supply of home-grown ra materials and at the same time to raise o production to a point where there will be a good sized exportable surplus.

VENEZUELAN RESOURCES OFFE EXPORT POSSIBILITIES

UNDER the direction of the Venezuela Commission of Inter-American Develop ment, a survey has been made of the in dustrial possibilities of Venezuela. Th survey found that the country has extensiv natural resources awaiting investment an development but high production costs and limited domestic markets present un favorable factors. However, the repor pointed out the possibility for the develop ment of production for export of such products as iron, fisheries, and alcohol.

MEXICO GRANTS CONCESSIONS FOR PHOSPHATE MINING

UNOFFICIAL reports state that Mexic recently granted three concessions for the exploration and exploitation of possibl phosphate-bearing areas. The concessions are said to cover 27 hectares a short dis tance from the city of Monterrey in the State of Nuevo Leon.

TURPENTINE DEMAND ACTIVE IN BRAZILIAN MARKETS

EXPANSION in the manufacture of paints varnishes, and floor waxes has increased re quirements for turpentine and turpentine substitutes in Brazil. Mineral spirits have especially grown in favor with annual con sumption estimated at 2,500 to 3,000 tons. The United States has been the leading supplier of turpentine and the principal outside source for mineral spirits. Tur

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pentine is not produced in Brazil but mineral spirits are produced in Sao Paulo by Industrias Matarazzo de Energia, S. A. with an output believed to approximate 150,000 kg. a month. Mineral spirits also are produced in Rio Grande do Sul.

ARGENTINA WILL PRODUCE ALCOHOL FROM CORN

According to information reaching the Department of Commerce, the Argentine Government will sponsor production of up to 120,000,000 liters of anhydrous alcohol from corn. The report states that the General Industrial Department of the Ministry of Agriculture has been put in charge of production and distribution of this alcohol. The corn will be supplied in seven metropolitan areas and at grain elevators in the production zones. Distilleries will be constructed along rivers with fast flowing currents for easy disposal of residues. Specifications call for alcohol with a minimum concentration of 99.8 deg. Much of this will be used for fuel and some will go into the manufacture of synthetic products. Actual production will be done by private firms under government contract.

SOUTH AFRICA HAS SUPPLIES OF NICOTINE SULPHATE

Nyasaland has a plant for the extraction of nicotine from tobacco scrap. Statistics for an eight-month period of 1943 reveal that 10,000 lb. of 50 percent nicotine sulphate were shipped to the African Explosives Co. in Durban, and 800 lb. of 83 percent nicotine delivered to the Cape Explosives Co. Both these companies produce insecticides and fertilizers as well as explosives.

NICARAGUA PRODUCES MORE VEGETABLE OILS

Although Nicaragua is a large producer of oil-bearing seeds, only small amounts of oil were processed until recently. Production of oils has been increasing in order to make up for the lack of lard and other cooking fats. The country has two oil extraction plants in Managua. One, of Italian manufacture, is powered by a German-made diesel motor. It has been in operation for eight years, principally in the production of cocoa butter, sesame oil, and castor oil.

POTASSIUM PERMANGANATE PRODUCED IN INDIA

Reports from India say that National Chemicals, Ltd., of Masulipatam, is now producing permanganate of potash in fine crystals, B. P., and technical grades. The company also turns out a fine grade of sodium acetate which is consumed in the textile industry.

BRAZIL HAS LARGE NEW TANNIN FACTORY

The largest factory which has yet been erected in South America for the manufacture of tannin was recently completed at Porto Murtinho, territory of Ponta Pora, formerly Mato Grasso, Brazil. Quebracho is the raw material used.

CORROSION FORUM

EDMOND C. FETTER, Assistant Editor

LITERATURE REVIEW

"Internal Corrosion of Tubing in Gas-Condensate Wells Measured by Recording Calipers," E. H. Short, *Oil and Gas Journal*, Jan. 6, 1945, pp. 46-47:—The recording caliper is an instrument for determining the extent of corrosion pitting inside the tubing of gas wells without removing the tubing from the well. It resembles a long pole 2 in. in dia. and 8 ft. long. Near the middle, three $\frac{3}{8}$-in. steel balls, 120 deg. apart, protrude through holes in the shell of the instrument, and as the instrument is drawn upward through the tubing the balls are pressed firmly against the walls of the pipe by a spring-loaded cone. Any in-and-out motion of the balls as they follow the irregularities of the pipe wall is transmitted to a stylus, and a continuous contour of the pipe is recorded on a moving tape. So that positive correlation can be established between points on the tape and points in the well, the tape is driven by a friction wheel which is mounted on a spring-loaded arm and held against the pipe wall.

"Cathodic Corrosion of Cable Sheaths," H. Halperin, *Electrochemical Society Trans.*, 87 (preprint 1), April 1945, pp. 1-14:—Serious corrosion, resulting eventually in electric failures of lead-covered power cables in underground concrete or tile conduit, may occur when the lead sheaths are negative to earth. In most cases, in the experience of the Commonwealth Edison Co., Chicago, the cathodic corrosion has occurred near street railway switches to which rock salt is applied in the wintertime. The sodium chloride penetrates into the soil and, at the sheath, is electrolyzed to alkalis by currents passing into the sheaths from the street-railway return system. The alkalis do the actual corroding. Several methods have been used to mitigate cathodic corrosion, and tests have been developed which locate corroded areas before actual failures interrupt electric service.

"Studies of the Mechanism of Solution of CO_2 in Condensate Found in Steam Heating Systems of Buildings," Leo F. Collins, *Heating, Piping & Air Conditioning*, Jan. 1945, pp. 36-41:—It has frequently been observed that the CO_2 content of condensates is far greater than theory would predict (Dalton's and Henry's Laws). The present study of the mechanics of condensation purports to reconcile theory and field findings by demonstrating (1) that common types of heating equipment favor the production of condensates containing a high percentage of the CO_2 carried along with the steam, and (2) that there is a progressive pick-up of CO_2 as the condensate moves down the return system.

"Corrosion Resistance of Common Metals and Alloys," L. G. Vande Bogart, *Factory Management and Maintenance*, Jan. 1945, pp. 145-148; from a compilation made by the Crane Valve Co.:—In tabular form, eight common metals are classified as "can be used, should not be used, or proceed with caution," with respect to about 140 corrosive liquids and gases.

"Stress-Corrosion Cracking of Metals," *Metal Progress*, Jan. 1945, pp. 75-78:—A resume, by a participating metallurgist, of important topics discussed during the three-day symposium sponsored jointly by ASTM and AIME, held in Philadelphia late in November 1944.

"Laboratory Tests to Predict the Performance of Metals Under Service Conditions," D. W. Sawyer and R. B. Mears, *Industrial & Engineering Chemistry, Anal. Ed.*, Jan. 1945, pp. 1-5:—Examples of laboratory tests are cited to support the proposition that the more closely laboratory test conditions approach the conditions of service, the more dependable the results will be. The subjects of the tests described are as follows: (1) corrosion of aluminum gas tanks in aircraft, (2) effect of steel, 18-8 stainless steel, aluminum, and copper on the properties of several grades of gasoline under storage conditions, (3) effect of steel, 18-8 stainless steel, tinplate, aluminum, copper, and zinc on the oxidation of a Pennsylvania lubricating oil at 120 deg. C., (4) cathodic protection of aluminum by zinc.

NEWS BRIEFS

F. L. LaQue has been named by the International Nickel Co. to head the newly created Corrosion Engineering Section of its Development and Research Div. Function of the new section will be to coordinate the broad interests of the company and its customers in the choice and applications of nickel-containing alloys where resistance to corrosion is required. Mr. LaQue has been with International Nickel since receiving his B.S. in chemical and metallurgical engineering from Queen's University in 1927. Since April, 1940, he has been engaged in development activities on all applications of ferrous and non-ferrous nickel-containing alloys. He is also chairman of the American Co-ordinating Committee on Corrosion whose activities were outlined in *Chem. & Met.*, Jan. 1945, p 173.

A Corrosion Prevention Laboratory has been established at the new Physical Metallurgy Research Laboratories, Bureau of Mines, Ottawa, Canada. This laboratory is furnished with the most modern equipment for corrosion research and testing. Its activities are under the direction of Dr. R. R. Rogers, formerly associated with Columbia University and later with the Welland Chemical Works and Wallaceburg Brass, Ltd. Up to the present time the laboratories have been engaged largely in work for the armed forces. However, an increasing amount of work is being done for Canadian firms manufacturing civilian goods.

A Corrosion research laboratory has also been established at Illinois Institute of Technology, Chicago, under the direction of Dr. Hugh McDonald. Purposes of the laboratory are to conduct a basic, long-range investigation of the fundamental theory of corrosion mechanisms, and to serve as a center for graduate instruction in the science and engineering of corrosion. Until the founding of this laboratory there was no combined educational and research center in the United States devoted exclusively to the many phases of corrosion. The laboratory accepts sponsored research projects from industrial organizations which seek aid in the solution of their individual problems, results to be published with full credit to the sponsors in all publications.

CORROSION REPORTER

Corrosion problems confronting small manufacturers are frequently somewhat different from those faced by large-scale producers in that corrosive solutions are transported about the plant not by pumps and pipelines but in carboys and buckets. The difficulties experienced by one small company, a firm of manufacturing pharmacists, are related by that company's chemical engineer. "Before the war we used white enamel, 5-gal. buckets, such as you might find in any hardware store, to carry corrosive solutions to any point where they might be needed in one of our operations. The corrosive solutions carried in these buckets were as follows: **amines, battery acid (dilute H_2SO_4), hydrochloric acid, caustic solutions (hot and up to 40 percent concentrated), aromatic ketones, acetic acid, and phenylacetic acid.** Any given bucket might be required to carry any of these materials in any rotation. The white enamel buckets were more than amply corrosion resistant, especially when you consider that before the war they were cheap and easy to obtain.

"However, during the war they became extremely hard to get, and in the hope of finding a substitute material for the white enamel coating we did considerable experimenting with Duralon. The results were

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not as happy as they might have been. While we have all the respect in the world for the corrosion resistance of Duralon in itself, we have not been successful in evolving a technique for coating the steel which will consistently give us a durable coat without blisters. We do know that blisters will certainly result unless the steel surface is meticulously cleaned before the Duralon is sprayed on. We also know that it is very important that the coat be sprayed on evenly. But even when we sandblast the pail and pickle it and take great pains to apply an even coat, we are not certain that the final job will be without blisters. To be fair in our estimate of Duralon, we want to say that when we do get a bucket properly coated, it gives excellent service and lasts considerably longer than the white enamel pails. After the war we will probably go back to the white enamel unless someone develops a method which will insure a blister-free Duralon coating.

"If such a technique is developed, we would like to see it applied to a cheap Japsco pump which we find useful for light transfer work. The pump is a bronze casting with rubber impeller, and while it will pump many materials without difficulty, the rubber impeller seems to bind and refuses to turn over only a short time after starting to pump **glacial acetic acid**. The rubber impeller does not appear to be swelled by its contact with glacial acetic; rather, the difficulty seems to stem from some unexplained friction phenomenon between rubber and brass in the presence of glacial acetic acid. Our thought is that if the impeller and casing could be successfully coated with some such resistant material as Duralon, a very serviceable, inexpensive chemical pump would be the result.

"For syphons and short pipelines we employ Saran tubing. The chemical resistance of Saran appears to be good enough to permit us to use it in moving any of the above-mentioned chemicals. The only shortcoming we have noticed is that it becomes brittle at elevated temperatures. Live steam, for example, has been carried in Saran tubing (at low pressure, of course) and at that temperature the tubing became brittle in a rather short time.

"In some of our processes it is desirable to distill **amines or ketones** from a water solution. This is accomplished in a still built of stainless type 316. **Sodium chloride** (which is soluble in water and insoluble in the amines or ketones) is added to the solution to obtain a distillate richer in amine or ketone and poorer in water. The result of this addition is that the residue at the end of the batch distillation is essentially a boiling slurry of sodium chloride. And the stainless-steel bottom of the still was rapidly attacked. It soon became necessary to replace the bottom of the still and stainless type 316 was again used, but to avoid further corrosion, sodium acetate was used instead of sodium chloride to reduce the proportion of water in the distillate. There has been no further attack on the still bottom.

"In another operation it is necessary to vaporize **glacial acetic acid** containing a small amount of **phenylacetic acid** and to superheat it to a temperature of about 600 deg. F. The equipment in contact

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"We are so enthusiastic over the performance of this magnet that we have purchased six more for delivery in the near future.

"You may be interested also to know that these magnets will replace other types magnets manufactured by other concerns."

*Name on application.

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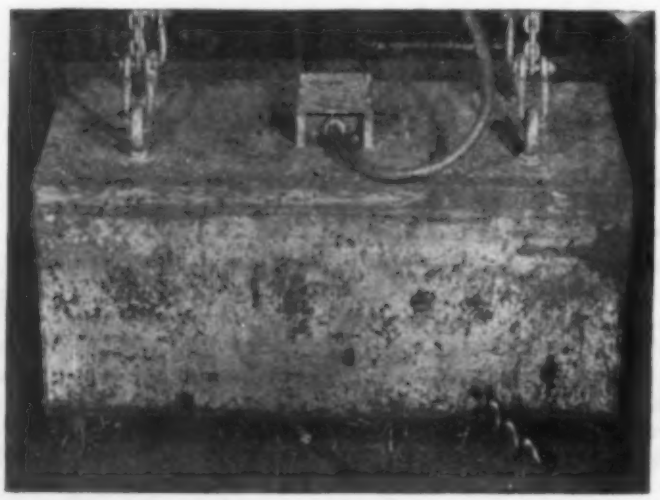
Letters like this confirm our belief that a well designed magnet, carefully built, results in satisfied and enthusiastic users and — is its own best salesman. See picture below.

Stearns Magnets are designed in all practicable sizes and shapes to suit your application whether it be for lifting or suspended separation purposes. If you want a dependable, powerful magnet, consult Stearns Magnetic Milwaukee.



STEARNS MAGNETIC MFG. CO.

629 S. 28th St., Milwaukee 4, Wis.

with this hot, airless vapor is built of stainless type 316. There is a small amount of corrosion at the weld points but otherwise the stainless steel is satisfactorily resistant to attack.

"Another corrosive we encounter is a fairly dilute, room-temperature solution containing **hydrochloric acid, sulphur dioxide, and hydriodic acid.** This is piped through graphite piping and valves and delivered into a yellow pine tank. Here live steam is introduced and the solution brought to boiling. The solution is agitated with a wooden, gate-type stirrer and difficulty was found in discovering a corrosion resistant material by means of which the upright members of the gate might be fastened to the revolving arms. Iron and stainless-steel bolts as well as wooden dowels were tried without success as fasteners. Finally we turned to glass and, after convincing the glass manufacturer that we were serious, we succeeded in obtaining glass nuts and bolts. These were installed three years ago and have held the gate together without mishap ever since.

"In our plant, diazotization reactions are carried out in stoneware vessels with monel cooling coils, monel having been found to be more resistant to the reagents used in the reaction than is stainless steel."

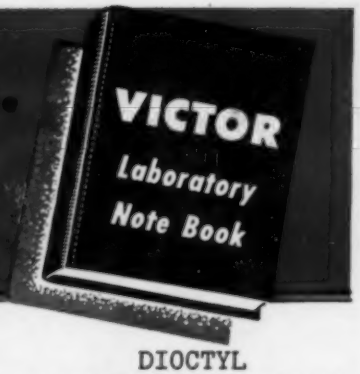
FROM the **sulphuric acid plant** operated in conjunction with a large oil refinery comes interesting information regarding the handling of sulphuric acid. The function of the plant, of course, is to supply the refinery with sulphuric acid and to recover as much of it as possible from the "sludge acid." This is the plant's design engineer speaking: "There is a basic trend in our plant to get away from the use of lead in handling dilute acids. Like most sulphuric acid plants, ours has been designed on the principle that cast iron and steel are the things to use with concentrated acids and lead is the best material for dilute. But during the years we have come to the conclusion that lead has so many shortcomings that we are bending all our efforts toward the discovery or development of materials which can replace lead throughout the plant. The characteristics of lead which we find most distressing are as follows: thermal expansion and contraction work hardens the metal and may eventually lead to cracking; lead will not stand great pressure; it has little abrasion resistance. Lead-lined steel pipe is a big improvement but erosion still ruins our pipelines in three or four years. There is still a lot of lead in the plant but little by little we are finding materials to take its place.

"In one particular system we have replaced lead entirely. This is a system wherein water is recirculated through a gas scrubber; it is part of our sludge decomposition plant. The system consists of the scrubber, a settling tank, a surge tank, and a pump feeding the recirculating water back into the scrubber. Gas from the sludge decomposing kiln enters the scrubber at about 400-500 deg. F. and consists of wet SO_2, miscellaneous hydrocarbons, coke particles and air. The purpose of the scrubber system is to remove the coke particles. The recirculating water

RESEARCH REPORT ... from the

New Chemicals Available for Industrial Research

SUBJECT—PHOSPHONATE ESTERS



SUMMARY OF PROPERTIES

Name	DIOCTYL PHENYLPHOSPHONATE	DIOCTYL STYRYLPHOSPHONATE	DIOCTYL I-OCTENYLPHOSPHONATE
Formula	$C_6H_5P(=O)(OC_8H_{17})(OC_8H_{17})$	$C_8H_7P(=O)(OC_8H_{17})(OC_8H_{17})$	$C_8H_{15}P(=O)(OC_8H_{17})(OC_8H_{17})$
Physical State	Liquid	Liquid	Liquid
Color	Yellow to colorless	Straw to colorless	Straw to colorless
Molecular Weight	382	408	416
Specific Gravity	0.967 (25°C)	0.973 (28°C)	0.909 (28°C)
Refractive Index	1.477 (N_D)	1.500 (N_D)	1.455 (N_D)
Acidity	<0.5 cc 0.1 N NaOH/10 cc to phenol.	<0.5 cc 0.1 N NaOH/10 cc to phenol	<0.5 cc 0.1 N NaOH/10 cc to phenol.
Hydrolysis	0.1 cc 0.1 N NaOH/10 g/2 hrs. in 100 cc boiling water to phenol.	0.2 cc 0.1 N NaOH/10 g/2 hrs. in 100 cc boiling water to phenol.	0.2 cc 0.1 N NaOH/10 g/2 hrs. in 100 cc boiling water to phenol.
Boiling Point	204–207°C (4 mm.)	235°C (4 mm.)	214°C (4 mm.)
Melting Point	Semi-solid at –70°C	Glass at –79°C	Viscous at –80°C
Surface Tension	32.3 dynes/cm (30°C)	32.7 dynes/cm (30°C)	29.6 dynes/cm (30°C)
Viscosity	27 centipoises (30°C)	57 centipoises (30°C)	21 centipoises (30°C)
Solubility	Sol. common org. solv.	Sol. common org. solv.	Sol. common org. solv.
Water Solubility	<.015 g/liter	<.0169 g/liter	<.0345 g/liter
Flash Point	370°F (open cup)	295°F (open cup)	395°F (open cup)
Fire Point	395°F (open cup)	325°F (open cup)	410°F (open cup)
Evaporation Rate	0.0031 g/sq. cm. (100 hrs. at 100°C)	0.0011 g/sq. cm. (100 hrs. at 100°C)	0.0078 g/sq. cm. (100 hrs. at 100°C)
Possible Uses	Plasticizer; anti-foaming agent; lubricant; oil-additive.	Plasticizer; anti-foaming agent; lubricant; oil-additive.	Plasticizer; anti-foaming agent; lubricant; oil-additive.

COMMENTS—These compounds represent a class of organic phosphorus compounds not previously available to industry. They differ from the well-known tertiary phosphate esters by having a carbon of one group directly attached to phosphorus. The octyl esters are high-boiling, inert, pure liquids which possess low evaporation rates, low water solubilities, and high degrees of compatibility in various resins

Methyl, ethyl, propyl, butyl, amyl, phenyl, and cresyl esters of the three phosphonic acids could be made available. They comprise a large group of neutral organic phosphorus compounds which possess many varied properties.

NOTE—Because of present limitations in the supply of certain critical materials, samples of the above and other Victor Research Chemicals announced from time to time are not always available. Those that are will be sent promptly upon request. Others, for which research has established important uses in essential war production, are already available in commercial quantities.

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runs at about 200 deg. F. all the time, and contains about 0.3 percent SO_3 (saturated at 200 deg. F.), up to 3 percent H_2SO_4, finely divided petroleum coke, and some petroleum oils.

"The scrubber, settling tank, and surge tank are all constructed as follows: the steel shell is sandblasted and pickled to get a clean surface and is then painted immediately, before rusting can even start, with a material known as Ceilcote. This provides good acid resistance, but the coating would be deteriorated by hydrocarbons in the water, so a coat of Ceilpour is applied over it. Then the whole vessel is lined with acid brick. This construction gives us much better all-round service than did lead-lined vessels in the same service. Points of exit and entrance through the walls of the vessels are protected by inserting thimbles made of an alloy having the composition 80 copper, 7 tin, and 13 lead. The spray assembly inside the scrubber, including the nozzles, is made of Durimet and is giving excellent service.

"Piping in the system is now made of structural carbon. This was installed after a 2-year period of testing and after considering a number of other materials including glass, porcelain-lined or enamel-lined steel. Rather recently a Van Stone type joint has been developed for joining lengths of carbon pipe. This innovation, in our opinion, gives vastly greater assurance of producing a durable joint than did the formerly used inside-gasket type joint. Most important, it almost completely eliminates the cantilever action on the flanges.

"The pump is a LaBour using alloy R-55 in its casing. Shaft failure is the only exception to its fine performance. Shafting for service such as ours is normally made of LaBour-G60, but this has not worked out satisfactorily for us nor has anything else we have tried. Of a goodly number of packing materials tried, an asbestos-base packing known as Alpax has seemed to give the most satisfactory service.

"The flue leading the cleaned gases out of the scrubber was first made of lead-lined steel. However, since the washed gases are not completely free of coke dust, the flue becomes coated with soot, and on more than one occasion this has caught fire with the result that the lead was completely melted away and the flue destroyed. We thought we might use stainless type 316 to build the flue, because 316 was used very successfully as the construction material for another piece of equipment exposed to much the same conditions. (Successful use of 316 was made in building the coke elevator which carries coke from the sludge decomposing kiln to the coke heating kiln. Like the flue from the scrubber, this elevator is exposed to hot, wet SO_3, the only outstanding difference being that the gas in the flue is at a temperature of about 200 deg. F. while the gas in the elevator is nearer 500 deg. F.). Preliminary tests of stainless type 316 in the flue showed that it was completely unsatisfactory in spite of the good resistance it showed in the coke elevator. Just a few weeks ago we installed some Haveg and hope that this will solve our flue problem.

"This flue gas is delivered to a furnace where its hydrocarbons are burned out

Versatile in its application

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Fairbanks-Morse Motor maintains its protective features in any position!

The reversible frame of this Fairbanks-Morse Motor provides for mounting the conduit box on either side. The lead-in can be from top or bottom. The bearing arms can be mounted in any one of four positions, 90 degrees apart. Thus, the motor may be installed in any convenient place—in any position, and still retain its protective features.

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Crossflow Ventilation—Another exclusive feature in frames 224 to 365 inclusive. Air moves in both directions, providing a motor of uniform temperature. No hot spots.

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Ball Bearings—Sealed in and protected.

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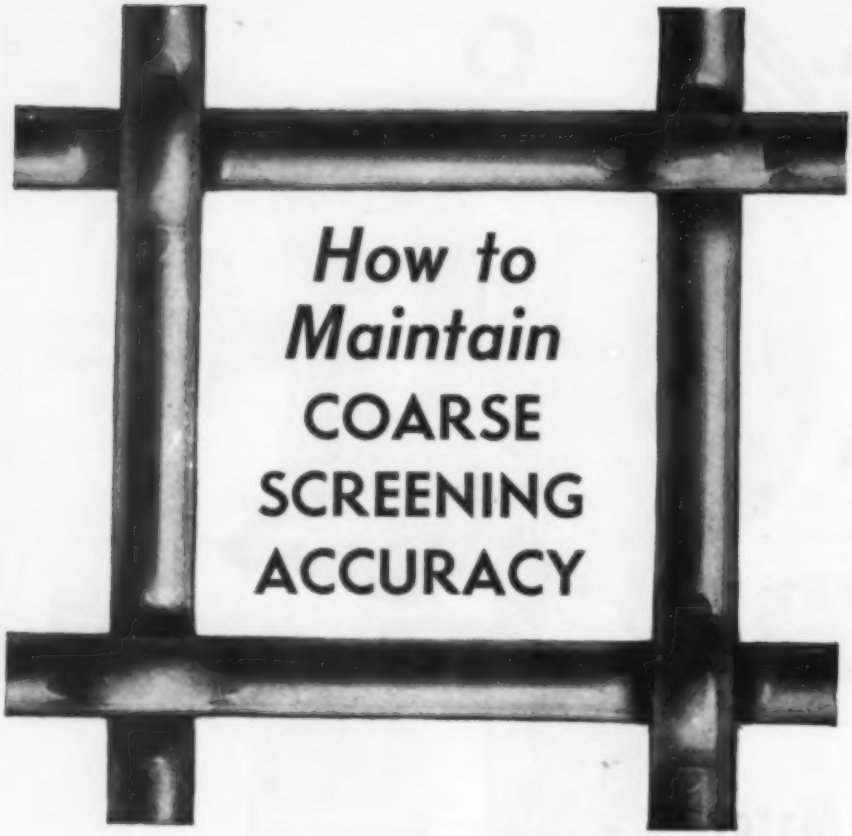

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Our ability to make accurate wire cloth is due to these factors: Nearly 70 years' experience in making cloth and in designing machinery for making it; making use of the most modern machinery possible; skilled workmen.

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and where all sulphur is converted to sulphur dioxide. The gases leave this furnace at a temperature of 1500-1800 deg. F. and are delivered to a cooling chamber where they are passed through a spray of cold water. We formerly made the spray nozzles out of yellow brass and they lasted only about three weeks. The nozzle is now made of Durimet and we get an average life of three years.

"In our converter vessels, where SO_2 is converted to SO_3, we have turned from cast iron to welded steel construction. The advantages we see in this are as follows: welded steel produces a vessel which is lighter in weight; it permits a design which has less tendency to warp; and it renders access to the inside of the converter easy, simply by burning a hole in the side of the vessel and then welding a steel plate over the hole when we have finished working on the inside. Warpage of the converter shell poses a serious problem, especially toward the end of a three or four year run when it is almost impossible to keep the circumferential joints from leaking. We are very anxious to find a gasket material which is better than the Blue Cape asbestos which we have used heretofore and which is standard for the job. The best prewar asbestos we were able to obtain became hard and brittle after a year or two and, lacking in resillience, it was unable to maintain a tight joint when warpage of the converter shell occurred in the latter stages of the run. In a few months we will have to dismantle a converter to clean out the catalyst mass and when we reassemble we plan to use a braided Inconel gasket made by Johns-Manville. We hope this will retain its resillience and maintain tight joints until the converter must again be dismantled three or four years from now.

"Pump packing is always a problem, but after trying a great many varieties we have come to look upon the following as about the most satisfactory: rubber for sludge pumps, Garlock 230 for oleum, the aforementioned Alpax for the weakly-acidic scrubber water and Garlock 736 for practically anything else.

"Pipelines handling acid sludge are faced with extremely severe conditions. The sludge may be so heavy and viscous that it is barely pumpable, which precludes the formation of any protective film due to the sludge's scouring action. Furthermore, it is subjected to the attack of hot sulphuric acid in any concentration from very dilute to oleum. The steel pipelines we are now using last only about seven months. After the war we plan to install red brass pipelines to handle all acid sludges, tests having shown that we may expect to boost the service life to at least three years. We will retain the fittings now in use. These are made of the same alloy as the thimbles previously mentioned in connection with the vessels containing scrubber water. We plan to join the lengths of brass pipe by means of the Walseal joint, developed by the Walworth Co. On the basis of longer life, reduced maintenance, and ease of fabrication, we believe that brass will prove to be more economical than steel for our sludge acid lines, and we plan to install them as soon as brass becomes available again."

FROM THE LOG OF EXPERIENCE

DAN GUTLEBEN, Engineer

BENJAMIN OXNARD SPRAGUE ("Ben" to all) (1878-1944) fitted into the sugar industry naturally. Uncle Robert Oxnard, having been absorbed with the purchase of his father's Fulton Refinery in New York by the American Sugar Refining Co., was made manager of the company's California interests. Ben acquired his engineering degree from Stanford in '97 and immediately became attached to the engineering staff of the Western Refinery where brother Dick was superintendent.

There was no glamour in the drafting room. Accordingly he threw up his job and sought an operating position in the refinery in the Potrero. Here he was assigned as assistant to assistant chemist Duperu for special training in the arts and amenities of the profession. The first day passed under the dignified relationship of master and apprentice. At day's end they boarded the old horsecar and landed at Third and Market Streets. There Mister Sprague modestly inquired if by chance Mister Duperu would join in a cocktail. Would he! They traveled the cocktail route of downtown San Francisco all night and fetched up at the refinery at six in the morning. They administered to each other a cold rubdown on the drainboard of the laboratory sink and by the time the boss arrived they were as fresh as daisies. For 50 years thereafter it was "Ben" and "Dupe" à la Jonathan and David.

The tales of exciting activities coming up from the construction camp of the beet sugar plants in Southern California were irresistible and so Ben got a job as a draftsman at Chino. Manufacturing sugarhouse operators was proceeding assembly-line fashion and Ben jumped on the line. Movement followed the famous baseball formula, "Tinker to Evers to Chance." Ben became assistant superintendent at the Oxnard factory. Then, Portius went to Caro, J. McCoy Williams to Oxnard, Ernest Hamilton to Chino. In '03 Hamilton to Rocky Ford, Ben to Chino, and a little later J. McCoy to Hamilton City and Duperu to Oxnard. The Oxnard outfit, known as the American Beet Sugar Co., had the advantage of territorial dispersion. It owned plants in California and Colorado and the construction affiliate was building factories for others in Michigan. The beet harvest and processing season was nearly completed in California by the time the eastern "compaigns" began. Thus it was possible to provide two years training in one. Ben acquired proficiency at all of the stations. As supervisor he became known for the severity of his vocabulary. However it possessed the subtle quality of detachment that inspired no resentment but vigorous effort and obedience.

On an occasion when Ben was boiling sugar at Chino, the night man at Rocky Ford had become incapacitated and Ben was dispatched to relieve Rollins. By the time Ben reached the pan floor in Colorado, Rollins had been on duty for 40 hours, having snatched a sandwich and a catnap when he could. Rollins then went to bed and slept 24 hours. In the meantime Ben was in distress. He could not raise the vacuum above 22 inches. He berated Rollins for neglect of maintenance of the pumps and piping. Rollins burst out in uproarious laughter. He slapped Ben on the back and asked him if he did not know that they were a long way above sea level. In fact Rocky Ford is a mile above Chino.

Rollins used to boil sugar at the old Adeline mill in Louisiana. Ben was boiling for the '99 season at Grand Island, Nebraska and, at its conclusion, dropped down to visit brother Dick at the plantation. Dick informed him that Rollins was on the pan floor and would like to see him. There was vigorous back slapping and then Rollins requested Ben to take off his derby and pinch hit at the pan while he stepped into the toilet convenience. Ben was pleased to accommodate but he saw nothing further of Rollins till the next morning. Rollins relaxed at poker and left Ben stuck at his post. Rollins had only two jobs, boiling sugar and playing poker.

In 1911 Ben was sent to the family plantation at Adeline to design and reconstruct the mill for white sugar production and to operate it as superintendent. Henry Knapke, Oxnard master mechanic, accompanied him during the off season and reported that "Ben really became quite a gentlemen!" The traffic in raw sugar slumped and a fire had damaged the plant, so Ben was commissioned to move his plant to Savannah where he built it into one of America's outstanding refineries. A few years later he arrived at the station of president.

Delightful old Ben passed on in January, 1944, and there is no doubt that a place was waiting for him to consort with the rest of the colorful "sugar tramps" now with the good Saint Peter.

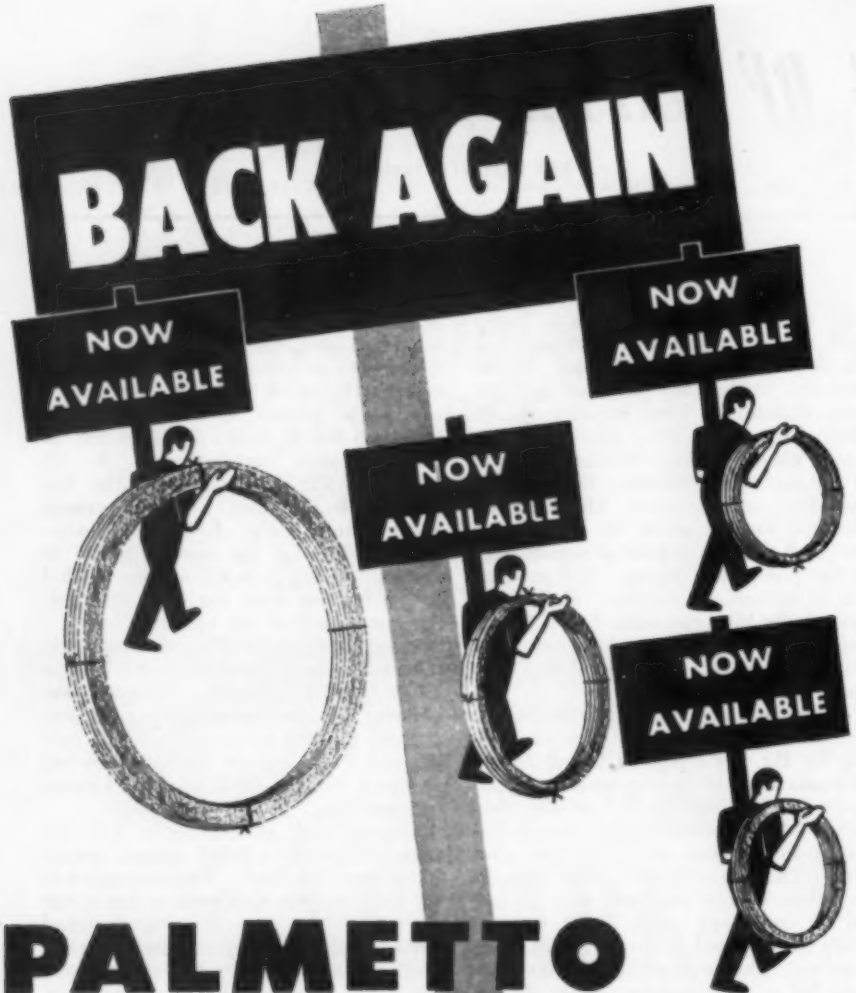
ALPHONSE M. DUPERU, "Dupe" everywhere in the industry, died last October on his hilltop at San Anselmo, Calif. This spot was the mecca that attracted peregrinating "sugar tramps" for discussion, advice and good cheer. In 1932 he relinquished the management of the great refinery of the California and Hawaiian Sugar Refining Corp. at Crockett and retired to enjoy his books, his jug and "thou."

The important circumstance of his career is none other than the old pattern of personal discipline but the path which he carved is unique. At 16 he was inspired with an impulse to become a sugar expert. He betook himself to the "American" sugar refinery at Union & Battery Streets in San Francisco and requested an interview with superintendent R. H. ("Dick") Sprague, brother of the late president B. O. ("Ben") of the Savannah Sugar Refining Corp. It was not customary in 1890 for the superintendent to grant interviews to a kid nor for the kid to ask for one from the superintendent. Sprague submitted two openings: one as a raw sugar weigher at $50 per month and one as a laboratory roustabout at $35. The kid requested guidance. Sprague propounded, "If you take the white collar job, you will probably be a — — clerk all your life and if you choose the laboratory job and work like the devil, you may amount to something."

Duperu took the laboratory job and started forthwith to absorb chemical atmosphere from the roots. The correctness of his judgment was vindicated within a year when the raw sugar job was abolished with the plant closing and the laboratory staff moving bodily to the amalgamated "Western" refinery. Here the Frenchman, Brysselbout, was temporarily in charge of the laboratory having been stationed there to be Americanized and groomed for Oxnard's pioneer beet sugar plant projected for Chino, Calif. One day while the kid was intent upon the job of filling reports, he received a sudden whack on the back of the neck that almost floored him. When he turned around, there stood the Frenchman with a stretched rubber band, exploding with laughter and pointing with pride to the dead fly on the floor.

Duperu's first three years were employed as night chemist. He was the sole occupant of the laboratory at night. He systematized the analyses so that the actual work demanded five hours. The time clock called for eleven, leaving six hours nightly to waste or to invest. He bought a college chemical set and supplies out of his $50 monthly stipend and dug down for the facts. To satisfy his craving for cultural learning as well, he selected a "five foot shelf" and proceeded methodically to devour it. The sample man who appeared at the wicket used to observe him pacing up and down the aisle reciting Shakespeare. He was called the "Herr Doktor" because of his ministrations to the injured, accident frequency being much higher then than now. This laid the basis of the understanding which throughout his career maintained a happy public relationship.

Later he circulated through the refinery to pick up nuggets here and there. What there was of the art and science of boil-



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ing sugar had not been reduced to public print. The price of transmitting the hokus-pokus to an apprentice was $150. Duperu did not possess the 150 nor, as he says even a reasonable prospect of acquiring it! However, one among the sugar boilers was willing to impart the mysteries of the masters for friendship's sake. To avoid detection of violating the obligations of the "guild," a surreptitious procedure had to be followed. The sugar boiler inculcated the art by remote control while the twain were sitting in the "bar-room-chair" in front of the pan, ostensibly visiting. All of the salient facts were absorbed and set down into the "hope chest." Years later when Duperu became night superintendent at the Oxnard, Calif., beet sugar house, he had two sugar boilers and a helper. Their arrogant manner irked him and, when it infringed upon his discipline, he fired them. This created consternation with the management but the training at the "Western" was called forth and shortly Duperu and the helper acquired the art sufficiently to carry on. This confirmed his mastership and never again did the sugar boilers dispute it. Thereafter secrets were abolished and the policy was established to train every foreman or willing aspirant in the technique of operation of every station in the House.

For seven years Duperu applied himself at the "Western" and grew in wisdom and stature. Then Dr. Hooker, the tall, lean chief of operations of the "American" refineries and its beet sugar interests, took cognizance and appointed him assistant superintendent. When refinery manager Dick Sprague left for the family plantation at Adeline, La., Duperu gave three months notice.

Then in July 1901 he left the refinery, liquidated his household effects, both as to assets and liabilities, and counted a residue of $70 and no job. He parked his wife and baby with his sister and left for a holiday in Oxnard, Calif., to consort with his old friends Ben Sprague and Walter Wayte. They quartered him at the guest house where the brothers Robert, Henry, and James Oxnard were sojourning. Duperu's youthful enthusiasm fascinated James and he was asked how he would like to join their outfit. Duperu, jobless but full of confidence, submitted that it would be highly agreeable to him provided that seniority, and the kinship of numerous present attaches would not obstruct his goal of superintendency if he merited it. James knitted his brows but, when the implications had penetrated, he nodded. And he kept his promise. Five years later Duperu was superintendent of the Oxnard factory and after Ben Sprague's departure from Chino for Savannah, he supervised both factories.

At that time the equipment had not reached a stage of standardization. Mechanical details lacked the robustness necessary for continuity of operation. Fatigue of steels was not understood. And besides, the operators, both men and management, were so busy learning and perfecting the processes that they overlooked the causes of mechanical failures. These were considered inevitable. When a 3-in. shaft failed, the quickest way to resume service was to replace it with a new 3-in. shaft.

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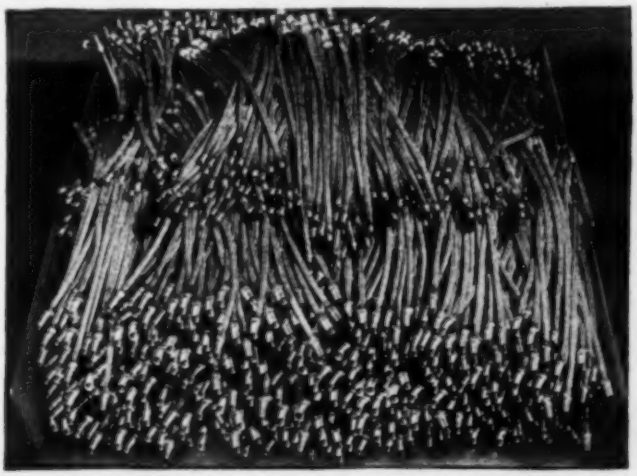
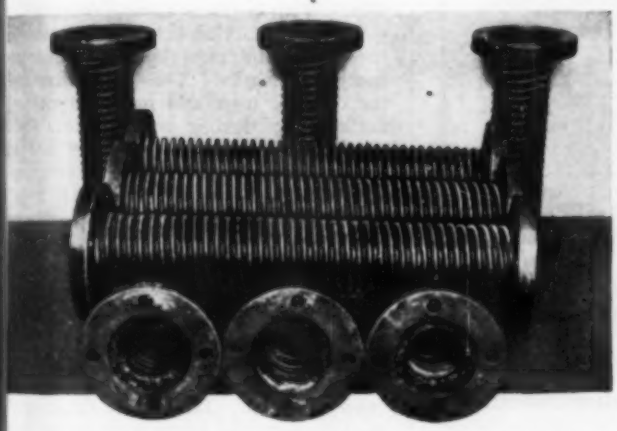
AIR STARTING LINES for locomotive diesels, involving pressures of 250 p.s.i., made of 2" I.D. bronze seamless tubing with bronze braid. Heavy duty steel flanges are Tobin Bronze welded.



HIGH-PRESSURE GREASE LINES for lubricating clutch release bearings on bulldozers and tractors, made of 3/16" I.D. TYPE M.P. steel hose, steel braid covered. Brass fittings are soldered on.



DIESEL EXHAUSTS absorb vibration, compensate for expansion and contraction. Made of 4" I.D. corrugated steel hose with welded flanges.

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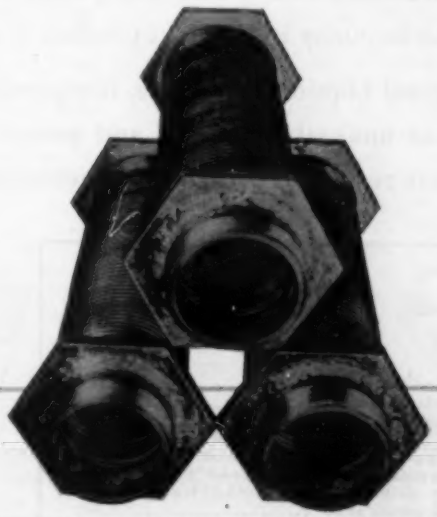
Bulletin No. SS-50, containing much useful information for manufacturers, engineers and machine designers, is yours for the asking. Write for it today.



WATER COOLED EXHAUSTS for PT boats also serve as vibration dampers to prevent line breakage. Made of 3" annular bronze seamless tubing with male fittings Tobin Bronze welded.

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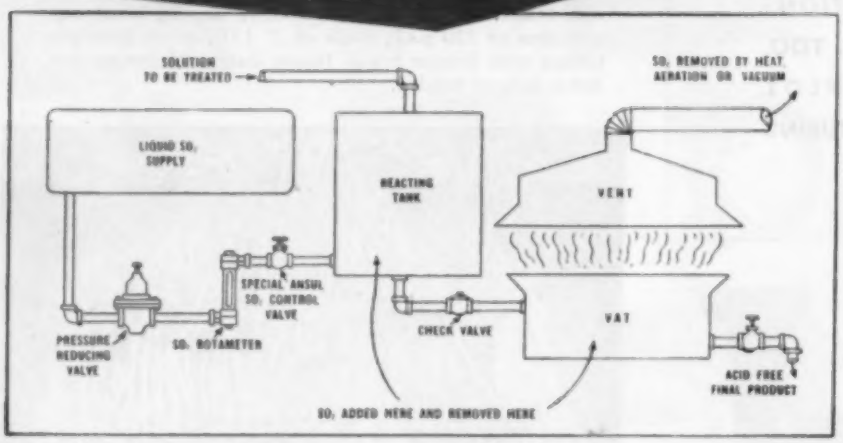

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• **Ansul SO_2, a volatile acid, provides distinct advantages over mineral acids when used as an acidifying and precipitating agent. 1—Excess acidity is easily eliminated. 2—Residual acidity that might otherwise be concentrated as an impurity in the final product is minimized.**

Ansul Liquid SO_2 is pure, inexpensive—easy to handle. It has unusual bleaching and preservative qualities and its use results in products of greater purity.

LIQUID Sulfur Dioxide ANSUL*

PHYSICAL PROPERTIES

Chemical formula	SO_2
Molecular weight	64.06
Color (gas and liquid)	Colorless
Odor	Characteristic, pungent
Melting point	−103.9° F. (−75.5° C.)
Boiling point	14.0° F. (−10.0° C.)
Density of liquid at 80° F.	(85.03 lbs. per cu. ft.)
Specific gravity at 80° F.	1.363
Density of gas at 0° C. and 760 mm.	2.9267 grams per liter (0.1827 lb. per cu. ft.)
Critical temperature	314.82° F. (157.12° C.)
Critical pressure	1141.5 lbs. per sq. in. abs.
Solubility	Soluble in water
Purity	99.9+% (by wt.) SO_2 (H_2O less than 0.01%)

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Duperu determined that most mechanical delays were due to thoughtless operation and maintenance. He postulated that a breakdown in either man or machine was a sin. This philosophy brought the plant for the first time to its rated capacity and breakdowns became rare under his relentless vigilance.

In 1915 Duperu returned to cane sugar refining, having been appointed plant manager of "C. & H." at Crockett, Calif. The war demands required enlargement and reconstruction of the works and plans had been prepared by an eastern outfit who were predominantly engineers but lacked operating experience. Building a new sugar refinery is not a frequently recurring job, while operators continually learn and develop. And so, in Duperu's experienced eyes, the plans were condemned. This precipitated an argument. Duperu won a vote of confidence. President Rolph and the directors handed him unconditional authority to design, build and operate—and subsequently to justify his stewardship. With engineer Louis Edmunds, he spent seven years on this job and evolved the largest and most luxurious sugar refinery in America. The high prices and the urge for more and more output permitted no slackening in operations, while on the other hand, construction had to go on at maximum speed without inconvenience to the customers. Such a job requires relentless push. His vigorous leadership drove men enthusiastically to their utmost.

The Crockett works now refines every day enough sugar to cover the average per capita consumption of 6,000 people for one year. Duperu's additional assignment was to build up operation personnel and a town to live in. He became the king of the village and by occasion the father confessor.

In 1931 when manager Rolph's health cracked, Duperu was advanced to the top position of Exective Vice President and General Manager. In '32, as noted above, he relinquished this job and was succeeded by his old friend Frank Sullivan. Thereafter he moved to a patch of California's choicest scenery and occupied himself as a gentleman farmer, for the most part in his well stocked library. For recreation he sailed and fished and contemplated the great number of youngsters whom he had "interviewed" and started on their way by kindly consideration and helpfulness.

During the Christmas holidays in '44 the Chronicler brunched at the famous San Anselmo hilltop and enjoyed a dish of scrambled eggs, personally and expertly prepared by Duperu himself. Both he and Mrs. Duperu were in good health and happy mood. Mrs. Duperu does not miss any of the little devices that provide pleasure for her guests. When Mr. Babst (Chairman Am. Sug. Ref. Co.) is her guest, the tea is "sweetened with Domino." For Mr. Bunker (Pres. of the National Sug. Ref. Co.) it is "Jack Frost." For Mr. Hoodless (Pres. of Pennsylvania Sugar Co. and the subsidiary Siboney distillery) the cocktail would be based on "Siboney." For Duperu himself the sugar bowl is filled with common C. & H. Thus Mrs. Duperu contrives to make everyone feel at home.

NAMES IN THE NEWS

Norman A. Skow, formerly with the Bakelite Corp., has assumed his new post as director of research, Synthane Corp., Oaks, Pa. Dr. Skow will devote his attention to research and development of Synthane plastics for technical applications.

Clifford A. Neros has joined the research and development department of the Diamond Alkali Co., at Painesville, Ohio. Dr. Neros was formerly with the American Can Co., at Maywood, Ill.

J. J. Duffy, Jr., a graduate chemical engineer, who has been associated with the Pennsylvania Salt Mfg. Co. since 1937, has been appointed assistant manager of sales. In his new capacity he will assist in supervising the activities of the special chemicals division's field men.

Fred W. Schmitz has joined Commercial Solvents Corp. research staff where he is doing pilot plant work and process engineering.

Harold W. Rehfeld, tire technician of the B. F. Goodrich Co., has received a commendation for exceptional civilian service from the War Department.

Harold B. Morris has been appointed technical representative of the Naugatuck chemical division, United States Rubber Co., and Dispersion Process, Inc., in the Akron area.

Harry M. Fisher has joined the research staff of Foote Mineral Co., Philadelphia, where he will head the grease research group. Mr. Foote, a chemical engineering graduate of Lehigh University, was formerly affiliated with the Atlantic Refining Co.

Arthur Schroder has been appointed executive director of the American Institute of Chemists. He assumes his new duties May 1, having been released from the Office of Alien Property Custodian.

R. C. Campbell has been named by The Dorr Co. to administer the company's European, African and Middle Eastern activities.

W. B. Pings, organic chemist, has joined the staff of Arthur D. Little industrial research organization. Dr. Pings was previously at the Experimental Station of E. I. du Pont de Nemours & Co.

Luther B. Martin has been appointed director of tire development and research of United States Rubber Co. with headquarters at Detroit.

Ralph C. Swann has been appointed director of research of American Mineral Spirits Co. in Chicago.

A. W. Bevernick has been named a vice president of R. J. Prentiss and Co.

O. B. J. Fraser

O. B. J. Fraser has been named head of the recently formed industrial chemicals section of the development and research division of the International Nickel Co. In the new section he will further expand the company's interest in problems in the chemistry and technology of nickel embracing particular attention to the preparation, properties and uses of nickel compounds, especially organic derivatives and nickel catalysts. He continues as director of technical service of International Nickel's mill products, a position he has held since 1934.

J. N. Carothers, former director of research with Monsanto Chemical Co., and the Federal Phosphorus Co., has been appointed chief of the Bonneville Power Administration's Industrial Analysis Section. He will work with Pacific Northwest research institutions interested in development of chemical and metallurgical industries in the region.

P. M. McHugh has assumed his new post as manager of the special process division, Great Lakes Carbon Corp., New York. Mr. McHugh resigned as director and vice-president of The Dorr Co. some months ago.

M. B. Gentry has been elected a member of the board of directors of Cuban-American Manganese Corp., a subsidiary of Freeport Sulphur Co. Mr. Gentry is a mining engineer who has been active in mining enterprises in both North and South America. He became a member of the Freeport organization in 1935 as assistant to the president.

Lewis F. Moody, of Princeton University, has been announced one of the winners of the Elliott Cresson Gold Medals in 1945, awarded by the Franklin Institute. Professor Moody's award was given in consideration of the leading part he has taken in the design and development of hydraulic turbines and pumps.

Affiliated Photo—Canada

F. L. LaQue

F. L. LaQue has been placed in charge of the newly created corrosion engineering section of the development and research division of the International Nickel Co.

Edward J. Nolan has been promoted by Merck & Co., from his position of plant manager for the Stonewall plant in Elkton, Va., to the position of assistant to the director of manufacturing at the main plant at Rahway. He will be responsible for operations at the Stonewall plant, and also for the company's plant at Philadelphia. **John H. Holcomb, Jr.,** a chemical engineering graduate of the Georgia School of Technology, has been named plant manager at the Stonewall branch. **Harold E. Mahony,** who earned his chemical engineering degree at the University of Pittsburgh, has been named assistant plant manager at Stonewall.

Robert P. Russell, president of Standard Oil Development Co., has been named a member of the nine-man civilian committee to appraise results of strategic air bombing in Europe. The new committee, known as the United States Strategic Bombing Survey, analyzes the effect of air bombardment on the will and capacity of the enemy to resist.

T. B. Counselman has been appointed by The Dorr Co. to head the firm's contract engineering division with headquarters in New York. He will be in charge of the negotiation of contracts and orders for research, development, pilot plant tests, plant and process engineering and design. Mr. Counselman comes to the New York office from Dorr's Chicago offices where he had been manager of the industrial division since 1928.

Johan Bjorksten has left his position as chemical director of the Quaker Chemical Products Corp. to establish an independent industrial research organization with offices in Chicago.

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The emphasis is on combining technical precision with ease of translation—throughout, the treatment is concise, explicit, and carefully organized for ready reference. The present day tendency in Germany to eliminate technical words of origin foreign to German is indicated by noting both the present-day usage and the more familiar German word, before giving the English definition.

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N. Beverley Tucker has returned to the Procter & Gamble Co., Chemical Division, from Devoe & Raynolds. He will be in charge of the soap research laboratory.

Charles A. Stringfellow and **Donald W. Jeffries** have joined Commercial Solvents' Engineering Division at Terre Haute as junior engineers. Mr. Stringfellow is a chemical engineering graduate of Rose Polytechnic Institute, and Mr. Jeffries has a B. S. degree in the engineering sciences from Harvard.

William S. Richardson has been made president of the B. F. Goodrich Chemical Co., just established with offices and laboratories in Cleveland. The company, a division of the B. F. Goodrich Co., is engaged in the manufacture and sale of Geon vinyl resins, chemicals and synthetic and reclaimed rubbers.

Halwyn R. Smith, formerly Pacific Coast editor of *Chem. & Met.*, has been appointed an industrial sales representative for the Bonneville Power Administration.

A. S. Woodard has been appointed assistant chief engineer of the Pennsylvania Salt Mfg. Co. Prior to this appointment, Mr. Woodard was senior chemical engineer.

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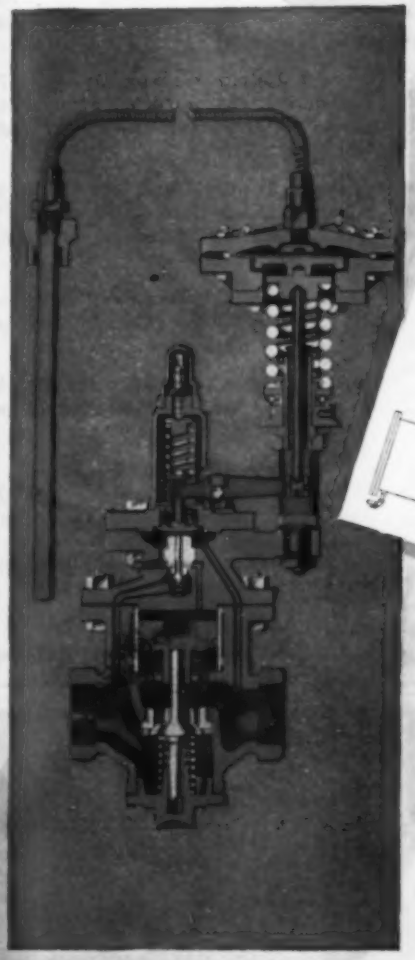

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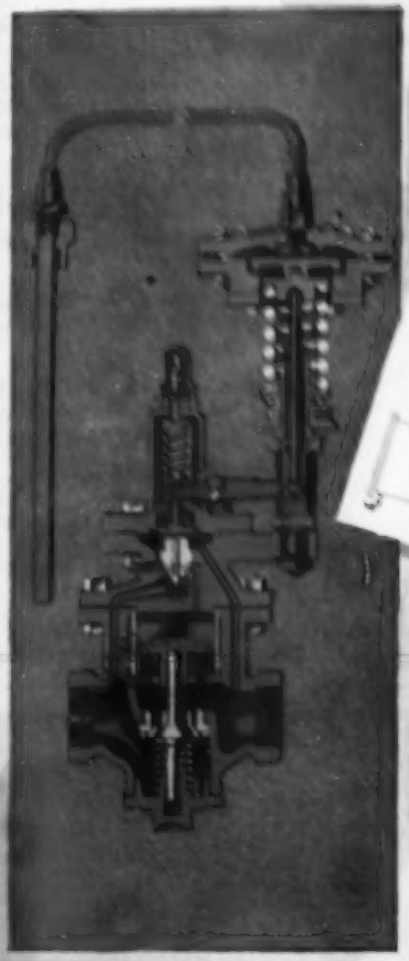

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INDUSTRIAL NOTES

Buffalo Forge Co., Buffalo, announces that Charles C. Cheyney, who had been serving as assistant sales manager, has been made sales manager.

A. O. Smith Corp., Milwaukee, has opened an office for its international division in the Commerce Bldg., New York with A. E. Cripps, newly appointed eastern supervisor, in charge.

Howell Electric Motors Co., Howell, Mich., has appointed Leroy F. Keely general sales manager.

The Foxboro Co., Foxboro, Mass., has added James M. Tuttle to the engineering staff of the Pittsburgh office. The company also has appointed William A. Rock resident engineer at Corpus Christi, Texas.

National Starch Products Inc., New York, has advanced Donald D. Pascal to the managership of its mid-western division with headquarters at Washtenaw Ave and 36 Place, Chicago.

Prufcoat Laboratories, Inc., Cambridge, Mass., has opened a branch office at 50 East 42d St., New York, and placed David E. Long in charge of its sales and service engineering.

National Atlantic Research Corp., Newton Center, Mass., has been incorporated to combine the facilities and personnel of the several laboratories of National Fireworks, Inc. with those of Atlantic Research Associates, Inc.

The Dorr Co., New York, has promoted C. K. McArthur to the position of manager of sales covering the United States, Mexico, Canada, Newfoundland and Alaska.

Dresser Industries, Inc., Bradford, Pa., has moved its centralized administrative offices to the Terminal Tower, Cleveland.

Hercules Powder Co., Wilmington, has named Hans A. Blum to succeed H. M. Thompson as acting manager of its office in Atlanta, Ga.

Aeroil Burner Co., Inc., West New York, N. J., has appointed Bernard Gould general sales and advertising manager.

Lukens Steel Co., Coatesville, Pa., has named E. Clair Book as assistant purchasing agent for the company and its divisions.

Westinghouse Electric and Mfg. Co., Pittsburgh, has purchased the Atlantic Elevator Co., Philadelphia. Fred B. Brust, first vice president of the Atlantic company will continue as manager.

Walter Kidde & Co., Belleville, N. J., has purchased the stock of the Young-

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Control the volume flow of dry chemicals and other bulk materials.

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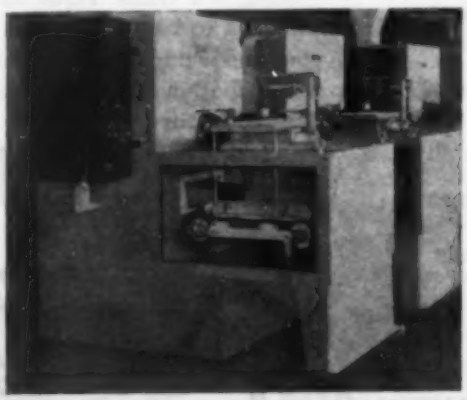
Vibrated, non-arching hopper.

Can also be automatically controlled by pH indicators, venturi meters, etc.



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Provide a positive accurate and automatic "Weigh-Flow" of chemical.

Eliminate all guess work—and feed exactly the right amount — by weight.

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"Bi-carb" is just as essential in hundreds of industrial operations . . . is the active ingredient in several types of fire fighting equipment . . . helps tan leather . . . prevents sap stain in lumber . . . performs importantly in the production of plastics, sponge rubber and in heat-treatment of special steels . . . neutralizes acids and removes caustic.

Through Mathieson Research, "bi-carb" assumes great new importance in the textile industry. Commercially developed, Mathieson's new process for removing caustic with "bi-carb" speeds up production, lowers cost, eliminates acid's disadvantages . . . removes caustic by *changing* it into sodium carbonate (soda ash).

The Mathieson Research and Technical Staffs are also applying "bi-carb" experience to certain phases of the paper industry. Perhaps their accumulated knowledge of "bi-carb's" versatility may hold important meaning for you—may bring to light possibilities you haven't thought of. *Co-operation means progress for all.*

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town Miller Co., Sandusky, Ohio. Orders on hand will be filled under the direction of F. L. Gerin who now is vice president and general manager.

Furane Plastics and Chemicals Co., Los Angeles, has been organized to produce plastics materials and chemicals derived from furfural.

Anthony Co., Streator, Ill., has announced the resignation of R. R. Howard as vice president and general sales manager. Glen A. Duis has been elected executive vice president and C. H. Worrells takes over the duties of sales manager.

Young Radiator Co., Racine, Wis., has added H. J. Kinkade to the contract product division where he will handle special work on evaporative cooling and similar type equipment.

Despatch Oven Co., Minneapolis, has opened a new sales and field engineering office at 221 N. La Salle St., Chicago. John H. Watson is general manager.

Continental Can Co., New York, has appointed G. E. DuCharme manager of paint and chemical containers sales.

The Lincoln Electric Co., Cleveland, has promoted W. R. Persons to the position of assistant sales manager. He will develop certain specific fields for the company's products.

Allis-Chalmers, Milwaukee, has reappointed F. S. Cockburn field representative in Peru where he represented the company for a number of years prior to the war.

Ferro Enamel Corp., Cleveland, has advanced George J. Buerman to the position of purchasing agent to succeed D. D. Macbeth, resigned.

Emery Industries, Inc., Cincinnati, has placed J. D. Faiella in charge of development and sales of a line of new fatty acid derivatives.

General Controls Co., Glendale, Calif., has appointed A. E. Hess manager of its branch office in Houston, Texas.

Detrex Corp., Detroit, has moved W. H. Webb from Indianapolis to the main office where he will serve as assistant sales manager of the alkali division.

The Girdler Corp., Louisville, has transferred Earle C. Call from the midwest to the New York office where he will direct sales in the eastern territory.

The International Nickel Co., New York, announces that Donald J. Reese who had been with the steel division of WPB, has resumed his duties with the development and research division.

Claude B. Schneible Co., Detroit, has appointed John C. Somers, industrial Products Engineering Co., Long Island City, sales representative in New York, Connecticut, and New Jersey.

Improved 3-Purpose Fire-Hose Nozzle by GRINNELL

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FLAMEBUSTER permits application of water in the form best suited for quick control, according to the nature of the fire —

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prevents clogging - simplifies maintenance

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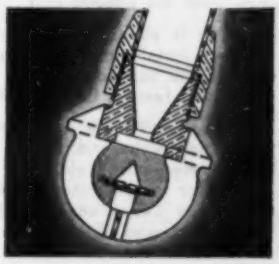
on end of the applicator breaks down the free flowing stream into finely divided spray without the use of small orifices – eliminates clogging.



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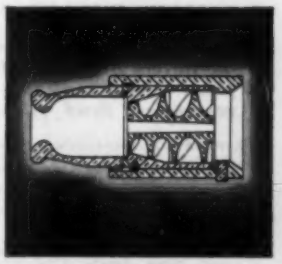
Generates high velocity spray by a proved "whirl" principle that eliminates the disadvantages of small orifices.



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Make a Good Water System

You can always put your utmost confidence in a Layne Well Water System. Everything from the method used in drilling and finishing the well to the design, manufacture and installation of the pump can be trusted for highest efficiency, most durable quality and the longest life of service.

Shown above is a system recently completed for a major food manufacturer. Running true to Layne form, this system out performs its guarantee, producing nearly twice as much water as other wells in the same locality. This manufacturer knew what to expect. He already owns four other Layne Well Water Systems, all of which have always given outstanding service. He knows how little it costs to operate Layne Systems, how much water these systems produce and how small the upkeep cost.

Layne is already in postwar work. Many postwar installations are now being made. Others will soon be started. All will be of the world famous Layne quality.

If you need more water, either from entirely new wells and pumps, or from efficiently modernized old ones, write, wire or phone for the planning and estimating services of a Layne engineer. No obligation. Address Layne & Bowler, Inc., General Offices, Memphis 8, Tenn.

LAYNE PUMPS — *fulfill every need for producing large quantities of water at low cost from wells, streams, mines or reservoirs. Send for literature.*

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VERTICAL TURBINE PUMPS

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THE SCIENTIFIC VACUUM POLICY

ENCOURAGING growth in the number of qualified chemical scientists since the turn of the century now comes up against a realistic fact which grows out of this country's wartime policy. By continued drafting of young scientists and by arresting the development of our scientific replacements, we are setting the stage for a scientific vacuum that will face the nation after this war. Consider the possibility of the war ending tomorrow. It would be six to ten years before there would be a graduating class of Ph.D.'s.

This condition becomes more alarming when we contemplate the course being followed by other nations. Having in the last war pursued the same course that we are following in this war, England is not now making the same mistake twice. She is not drafting her scientific personnel. To the contrary, she is rendering every encouragement to science with the specific purpose of insuring adequate postwar replacements. Even in the darkest days of Stalingrad, Russian manpower requirements never reached the stage where Russia felt it necessary to call on her scientific men to bear arms.

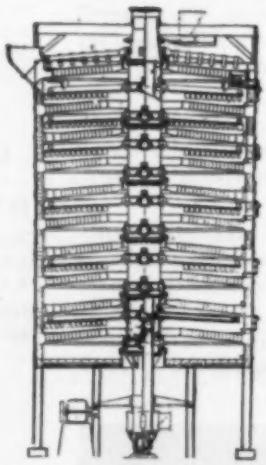
This leads inevitably to speculation on what we in America will face after the war in competition with other progressive nations—nations which will be adequately equipped with trained scientific replacements. Let us not assume that we can maintain our leadership without continuing to conserve and train scientists. This cannot be done.

Lucas P. Kyrides, Monsanto Chemical Co., Midwest Award Medalist, before St. Louis Section, American Chemical Society, St. Louis, March 5, 1945.

NEW CHEMICALS FROM WAR

THE CHEMICAL industry in war has developed new chemicals and intensified production of strategic materials which promise many new peacetime uses. New plasticizers can make plastic films that will not stiffen with age, belts and suspenders that stay pliable in cold weather, and lacquers

THERE IS A GOOD REASON WHY
"THE NICHOLS WAY"
of Roasting — Calcining — Drying is
SIMPLE · ECONOMICAL · DEPENDABLE



Operating records of thousands of furnaces installed, processing scores of materials, are constantly analyzed and advancements in design incorporated in Nichols Herreshoff Multiple Hearth Furnaces.

This continuous advancement has resulted in the establishment of remarkable records because of flexibility of design, compactness, small space and low power consumption.

Nichols offers the Process Industries a complete Engineering Service as consulting and designing engineers and construction managers for the construction of new, or the modernization of existing plants.

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STAND A SHOCK?

CARBON AND GRAPHITE can be heated to incandescence and plunged into cold water without the slightest harmful effect!

This extraordinary resistance to thermal shock is the basis of many applications of "National" carbon and graphite and of "Karbate" products* in the metals, chemical, electronics, textile and other industries.

But these materials also have other equally important qualities. So you must think of them in terms of *all* their properties . . . in combinations possessed by no other materials.

It will help you to understand why carbon run-out troughs give up to six months' service in steel mills . . . why graphite anodes made the mercury-arc rectifier practical . . . why graphite molds for ferrous and nonferrous metals don't crack, spall or stick . . . why graphite bubble caps retain their original dimensions throughout the heat cycle of any chemical tower . . . and why "Karbate" heat exchangers resist practically all acids, alkalies and solvents.

Our nearest Division Office will gladly furnish full details.

*Impervious carbon or graphite.

The words "National" and "Karbate" are registered trade-marks of National Carbon Company, Inc.

BAR OF WHAT?
Carbon, Graphite, or "Karbate" materials, of course!

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KEEP YOUR EYE ON THE INFANTRY . . . THE DOUGHBOY DOES IT!

A $13 MILLION
Market for
CORN PRODUCTS
in the Southeast

Can be best served by a plant in

Alabama

PUT these facts in your postwar planning file. They will be worth remembering:

√ The Southeastern market for corn products is estimated at $13,000,000 annually. None of this is supplied by plants in this region.

√ Corn production in the Southeast (1944) was 426,475,000 bushels. This can be supplemented by supply from the Midwest corn belt, economically shipped to production points in Alabama by barge on river system, at substantial saving in transportation costs.

√ Soda ash and sulphuric acid are available in Alabama and other Southeastern states.

√ Low-cost steam coal, favorable industrial power rates, mild and equable climate.

√ A large and stable source of labor will be available in the postwar period.

For further information write Dept. C, ALABAMA STATE CHAMBER OF COMMERCE, Montgomery 1, Alabama

ALABAMA
STATE PLANNING BOARD
Montgomery 5, Alabama

that will be more permanently non-brittle. Plastic shoe soles can be made which will withstand hundreds of thousands of flexes without cracking.

Butadiene, styrene and polyethylene for synthetic rubber manufacture are perhaps the best example of how the organic chemical industry has met vital national needs. When the war is over, large quantities of these chemicals will be available for a variety of applications. Butadiene probably will continue as an important constituent of many copolymer elastomers, and it is a potential intermediate for production of industrial organic chemicals. Styrene can be used in elastomers and as polystyrene, and as an intermediate in manufacture of a number of chemical plasticizers, resins, dyestuffs, and pharmaceutical preparations, while polyethylene also is a source of a new, tough, flexible plastic with remarkable electrical characteristics and exceptional resistance to chemical attack.

Another plastic raw material developed for the war is allyl alcohol. It can readily be converted to such valuable chemicals as acrolein, propionaldehyde, glycerin chlorhydrins, the anesthetic gas cyclopropane, and a host of esters that polymerize to resins of exceptional clarity and hardness. Pentanedione, or acetyl acetone, is another reactive chemical produced for the first time during the war, and it is now available in commercial quantities for production of sulfamethazine, metallo-organic chelates, and salts used for the recovery of metals and as deactivators and inhibitors in gasoline.

Water-soluble hydroxyethyl cellulose is another chemical, made for secret war purposes, which is efficient for the warp sizing of cotton and rayon textiles, and the sizing of paper to prevent ink absorption.

New higher polyethylene glycols are serving as water-soluble, petrolatum or wax-like solids for pharmaceutical ointments that are easily removed with water. They are good solvents for most of the sulfa drugs, and many other drugs which have heretofore not been satisfactory when used with unctuous bases such as lanolin and petrolatum.

Also from the war has come a remarkable new insect repellent, ethylhexanediol, and with peace it will be available not only for this purpose, but as an intermediate in the synthesis of resins, plasticizers, and other products.

These war-born chemicals all have exciting peacetime possibilities, and are but examples of the many products of the chemical industry which will serve mankind in peace as well as in war. The chemical industry will be in the vanguard of man's continuing struggle against poverty, disease, and war itself.

R. L. Bateman, Carbide and Carbon Chemicals Corp., before Toledo Section, American Chemical Society, Toledo, March 22, 1945.

CARBON DIOXIDE SNOW

CARBON dioxide, used for carbonating beverages and in solid form as a refrigerant, has had quite limited uses as a fire extinguishing agent until recently. Now, however, carbon dioxide has become a major industrial chemical. Approximately

AMERSIL*
What?
NO EXPANSION!
Well! Hardly Any.
Amersil's* low coefficient of expansion is one of its outstanding characteristics. It is only 0.000000054. This is 1/34 that of copper, 1/17 that of glass or platinum and 1/9 that of tungsten.
This characteristic of Amersil* chemical and industrial plant equipment—piping, absorbers, cooling sections, etc., permits extreme temperature variations. Operation at temperatures as high as 2100°F. may be maintained regularly, or up to 2700°F. for short periods, and widely varying temperatures may be carried in the same apparatus.
A new Amersil* Catalog is on the press. Write, on your business letterhead, please—and reserve a copy.
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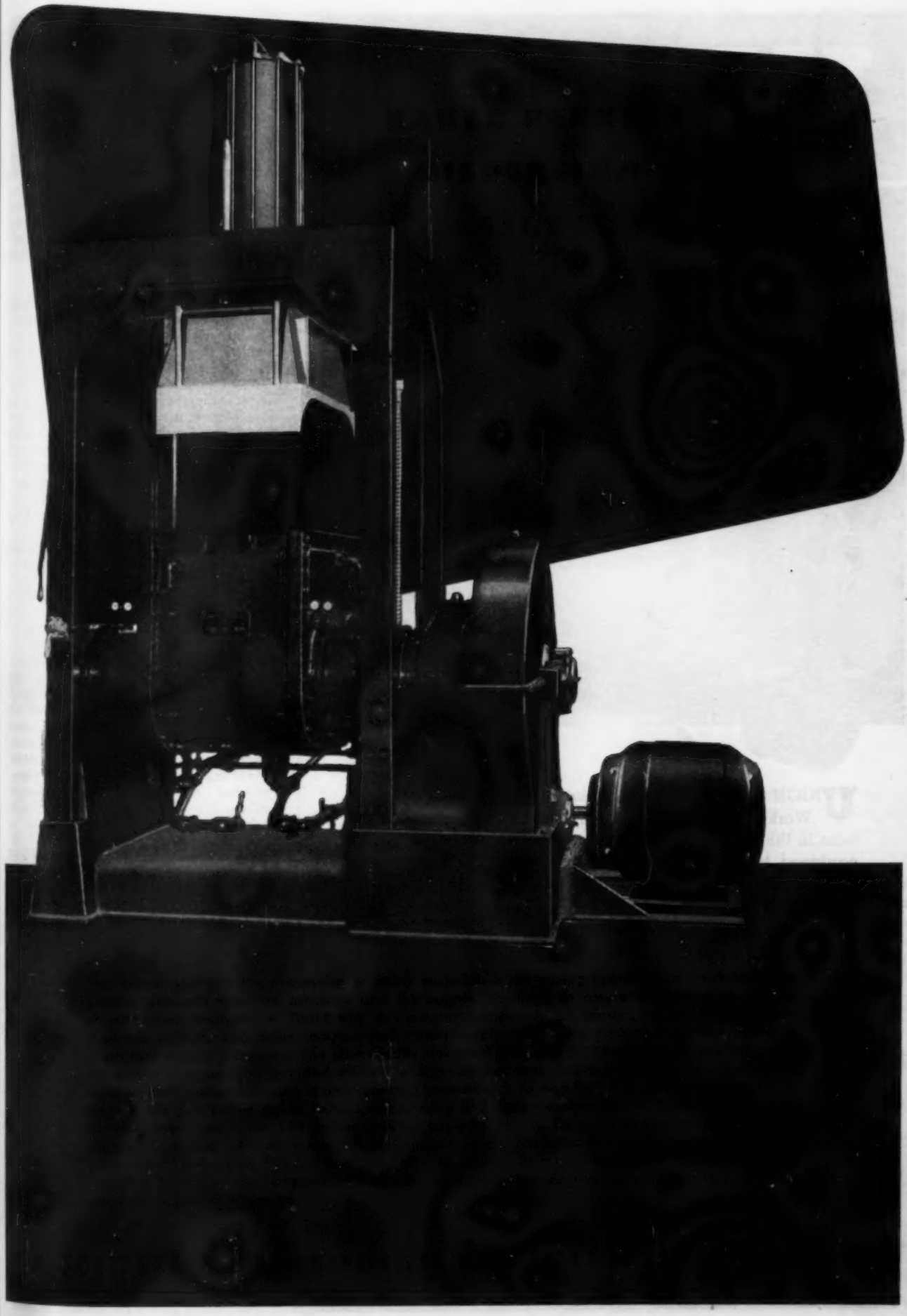
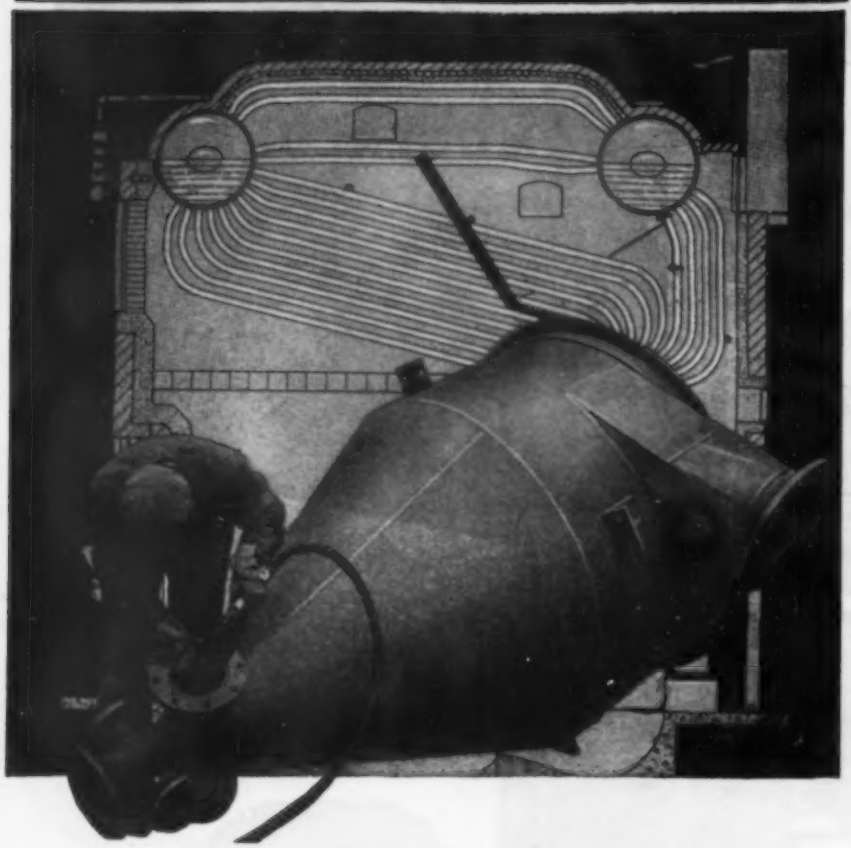
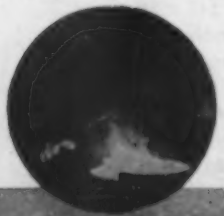


UNION



UNION Welded Pressure Vessels and Fabricated Steel Work to specifications are speeding into vital applications in the Chemical and Process Industries. Our shops are equipped to roll heavy plate, hot or cold to 26 feet width, A. C. & D. C. and Atomic Hydrogen Welding Equipment, checked by X-Ray, Gamma Ray and Magnaflux inspection to assure highest quality welded construction.

Large, automatically controlled, stress relieving furnace capacity provides uniform temperature and slow cooling.



Send your pressure vessel and fabrication specifications to Union of Erie for highest quality workmanship. *Write for booklet on facilities.*

PRESSURE VESSELS

STEAM GENERATING EQUIPMENT

25 percent of the production of liquid carbon dioxide in this country now is used in mining coal. Low-pressure carbon dioxide fire extinguishing has increased consumption of liquid carbon dioxide tremendously, and this method of combatting fires is playing an important role in the war.

Gaseous carbon dioxide can be converted to a liquid only if compressed to over 60 lb. per sq.in. pressure. At this pressure, its temperature must be reduced to minus 70 deg. F. before it will condense to liquid. At 70 deg. F., normal room temperature, the vapor pressure of liquid carbon dioxide is approximately 850 lb. per sq.in.

Because of this high vapor pressure, liquid carbon dioxide has been handled only in relatively small, high pressure cylinders, the usual cylinder capacity being 50 lb. of liquid carbon dioxide.

When liquid carbon dioxide is maintained at approximately zero degrees, its vapor pressure is approximately 300 lb. per sq.in. Liquid carbon dioxide is now being transported and stored in large pressure vessels maintained at this low temperature by means of thermal insulation and refrigeration. The largest single storage vessel for liquid carbon dioxide at the present time has a capacity of 125 tons.

The quantity of liquid carbon dioxide discharged at a single time into a single hazard varies from a few pounds to as much as 14 tons. The low pressure method of handling liquid carbon dioxide makes it possible to ship it in railway tank cars of 24 tons capacity.

This low pressure liquid fire extinguishing medium has enhanced fire extinguishing properties over the conventional high pressure liquid carbon dioxide because of the large carbon dioxide "snow" yield when it is released into a fire. Liquid carbon dioxide released from a storage temperature of zero deg. F. flashes to snow and vapor. Forty-five percent of the discharged medium is snow. Liquid carbon dioxide discharged from a storage temperature at 70 deg. F. yields only 29 percent snow. At 87 deg., it yields 21 percent snow and 79 percent vapor.

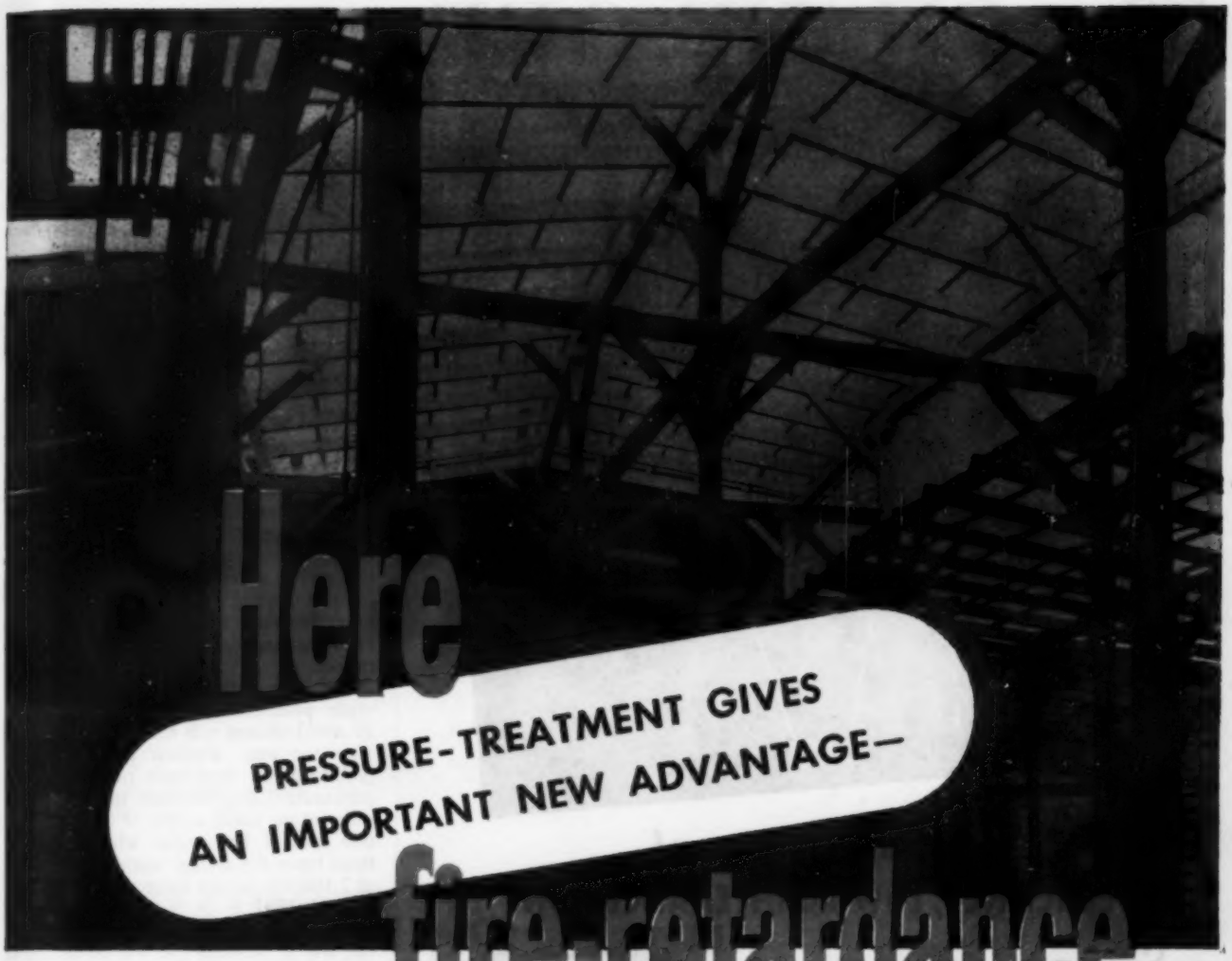
Since solid carbon dioxide is much more dense than cold gaseous carbon dioxide, this large snow yield makes it possible to extinguish large fires outdoors in the presence of high winds.

C. A. Getz, Cardox Corp., before Iowa Section, American Chemical Society, Iowa City, March 22, 1945.

LONG-RANGE RUBBER POLICIES

IT WILL be two or more years after the liberation of the Eastern rubber plantations before capacity production of synthetic rubber and deliveries of natural rubber to consuming countries will exceed world consumption. Unlike most other international problems this interval affords ample time for fact-finding and for formulating sound policies and a start in this direction has been made.

Synthetic rubber of all types is now being produced in the United States at the rate of about 850,000 tons a year and before the end of 1945 this rate will probably be stepped up to a million tons a year. This record production of man-



In this new building, Koppers Hi-retention CZC Pressure-treatment not only protects the wood members against decay, but gives a high degree of fire-retardance as well.

Under elevated temperatures, even untreated wood members retain their strength longer than structural metal members of equal original capacity. This natural property is reinforced and multiplied by treatment. Underwriters Laboratory tests of wood treated by this process show a 60% reduction of flame spread and a 65% reduction of fuel contributed, on a scale with untreated oak at one end and asbestos cement board at the other.

By making wood fire retardant, Koppers Hi-retention CZC Pressure-treatment further increases the long list of advantages that recommend treated wood for permanent structures: low first cost; minimum maintenance; ease of fabrication and erection; freedom from corrosion from fumes and dampness due to process operations; and all-around durability and dependability. We will pre-frame wood to your blueprints, treat, and ship it ready for assembly; or we will treat and return members pre-framed in your shops. You will find it profitable to review the economy and utility possibilities of pressure-treated wood in your building program. Let us know your wishes.

KOPPERS COMPANY, INC. • WOOD PRESERVING DIVISION

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Buy More War Bonds—
and Keep Them!

THE INDUSTRY THAT SERVES ALL INDUSTRY

The SHAVE-OFF

Buell's assurance of
HIGH EFFICIENCY, LOW MAINTENANCE, LONG LIFE

SUCCESSFULLY utilizing the "double-eddy" current—an aero-dynamic phenomenon present in all cyclone-type collectors (established by van Tongeren)—Buell, and Buell *only*, effectively puts this force to work by an exclusive mechanical feature known as the "Shave-off". By means of this design feature, the important "fines" are collected and by-passed to the lower part of the cyclone where the downward flow of the "double-eddy" current automatically carries them to the dust discharge outlet.

In ordinary cyclones, this dust circulates under the top plate, finally dropping by gravity through the upward, rotating gas stream of the "double-eddy" current. Thus, in its passage to the dust discharge outlet, the "fines" become re-entrained in the gas flow and are partially lost through the gas outlet.

This exclusive feature of the patented Buell (van Tongeren) cyclone is a prime factor in Buell's well-known high recovery efficiency.

BUELL FEATURES

SHAVE-OFF
LARGE DIAMETERS
EXTRA-STURDY CONSTRUCTION
CORRECT HOPPER DESIGN
SPLIT-DUCT MANIFOLDS
INNER WELDS GROUND SMOOTH

RESULT IN

HIGH COLLECTION EFFICIENCY
LESS FAN BLADE WEAR
LOW DRAFT LOSS
LOW POWER CONSUMPTION
HIGH TEMPERATURE RESISTANCE
UNLIMITED CAPACITY
NO MOVING PARTS
FREE DUST FLOW

PRODUCE

HIGH EFFICIENCY
LOW MAINTENANCE
LOW OPERATING COST
LONG LIFE
NO CLOGGING

buell
DUST RECOVERY SYSTEMS

Convincing facts about the "Shave-off" may be found in Buell's bulletin—*"The van Tongeren System of Industrial Dust Recovery"*

BUELL ENGINEERING COMPANY, INC.
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Sales Representatives in Principal Cities

DESIGNED TO DO A JOB, NOT JUST TO MEET A "SPEC"

made rubber has been accomplished in three years since the fall of Singapore. United States' consumption of rubber,—natural and synthetic—in 1944 was 713,000 tons of which 80 percent was American-made synthetic. Toward the end of last year a new top priority program for the production of military tires was announced, and consumption of rubber may approach 900,000 tons in 1945 of which more than 85 percent will be synthetic.

More natural rubber to mix with synthetic rubber in the manufacture of large truck tires is urgently needed. Synthetic rubber can and will be supplied in quantities needed to meet the new requirements. However, it will be necessary to increase substantially the production of rayon and carbon black and to construct tire manufacturing plants in addition to the expansion of facilities started last year by the rubber industry and financed by it to a total of some $75,000,000. Meanwhile manpower is still urgently needed in several localities to produce essential materials, tires and other vital rubber products to the limit of existing plant capacities. Belting, hose, footwear and other products have been successfully converted to synthetic rubber.

It is now estimated that the potential yearly production of natural rubber from all world sources will total 1,500,000 tons after the war. Postwar potential yearly production of man-made rubber will approximate 1,300,000 tons making a possible future world supply of about 2,800,000 tons of both types which is nearly three times the average world consumption of 1,100,000 for the three years from 1939 through 1941.

Nothing must be permitted to stand in the way of winning the war as quickly as possible and with the least suffering and loss of human life. Nevertheless, it is now time that we the people should be seriously thinking about the long-range political and economic problems resulting from the existence of America's synthetic rubber-making capacity.

John L. Collyer, B. F. Goodrich Co., before Pittsburgh Chamber of Commerce, Feb. 14, 1945.

COLOR OF ELECTROLYTIC CAUSTIC LIQUOR

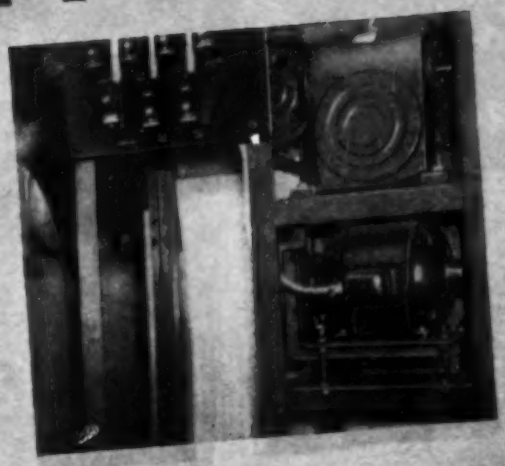
ELECTROLYTIC caustic produced by any type of diaphragm cell has a characteristic blue or purple color. This color is objectionable because it is obviously an impurity and as such has been blamed for various troubles encountered in the later use of the caustic. The blue color disappears when the caustic is fused and at the same time most of the iron in the liquor is precipitated as oxide. In several industrial operations it has been necessary to redissolve fused caustic to make a strong liquor of low iron content and free from the blue color. For many years association of ideas has linked the blue color with iron.

In order to sell 50 percent caustic in tank-car lots it is generally necessary to get rid of the blue color. Most manufacturers have developed some process for decolorizing and clarifying strong caustic liquor. This usually consists of bleaching with chlorine, followed by settling or filtering. It was in or about 1925, in connection with

IN STUFFY SPOTS

Many a motor must be located where walls, adjacent equipment, or materials cut down the free flow of air. Sometimes, as in the case of this wool-dryer drive, surroundings are hot, and stuffy, too.

Tri-Clad motors have proved themselves cool-running even under such conditions. Their powerful, double-end ventilating system moves the air at controlled velocity for effective heat removal. The location and baffling of dual exhaust ports discourage recirculation.



Tri-Clad motor drives conveyor on wool dryer—Bigelow Sanford Carpet Co., Amsterdam, N. Y.

AIR-FLOW TESTS OF TRI CLAD MOTORS LEAD TO PROTECTION FROM OVERHEATING

Plenum chamber test of Tri-Clad motor ventilation at G-E motor factory.

Before new types or sizes of Tri-Clad motors are approved for production, plenum chamber tests are conducted on the ventilating systems of sample models. These measurements serve as a check on previous calculations of the volume and velocity of air through the motor under different conditions. Other tests under load within enclosures and at abnormal ambient temperatures are also made. If your motors must be confined in stuffy spots, G.E. can help you make the right choice to beat the heat. *General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

Buy all the BONDS you can—*and keep all you buy*

Unskilled labor adds nothing to a product except cost
this is the Modern way...
CLARK
How to make every foot of space pay bigger returns—how to change materials into revenue—faster!... Use—
CLARK fork trucks
GAS OR ELECTRIC POWERED
CLARK EQUIPMENT COMPANY
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Products of CLARK • TRANSMISSIONS • ELECTRIC STEEL CASTINGS
AXLES FOR TRUCKS AND BUSES • AXLE HOUSINGS • BLIND RIVETS
INDUSTRIAL TRUCKS AND TRACTORS • HIGH-SPEED DRILLS AND REAMERS
METAL SPOKE WHEELS • GEARS AND FORGINGS • RAILWAY TRUCKS

development work on the production of a more marketable white caustic liquor, that interest was aroused in the nature of the blue color. The question of the constitution of the coloring substance was at times so intriguing that development work was set aside for research work.

A crystalline organic compound, which produces the color of electrolytic caustic, has been isolated from a water extract of old graphite stubs. This compound has an empirical formula of $C_{10}H_4O_4Cl$, and seems to be pyromellitic acid-chloroquinone. It is a very stable compound not destroyed by aqua regia or nitro-sulphuric acids. It can be decomposed in steps by fusion with NaOH to give a residue of phenols, NaCl and Na_2CO_3. It is probably a product of oxidation of the graphite anode.

H. H. Heller, Kimberly-Clark Corp., paper prepared for presentation at 87th general meeting of The Electrochemical Society, Atlantic City, April 12–14, 1945.

A NEW ERA OF RESEARCH

THE COST of this war must be paid and that can only be done by drawing upon the productive capacity for years to come. We are not going to have as much as we had in the good old days, unless we develop means for increasing productivity and are willing to put in the man-hours required to accomplish it.

Research covers a field as broad as the universe. Industrial research is only a narrow part. Besides such fields as biology, bacteriology, chemotherapy, astronomy, electronics and nuclear physics, and many others, there is the general field of pure unapplied research. There is also social and political research. There will be a great demand for the production of material things such as automobiles, radios, refrigerators, washing machines and thousands of others that have come to be considered as necessities, when the war is ended. If we do not plan more intelligently for controlling this demand, than we did after the last war, we shall repeat the rapid inflation and the consequent cycling from inflation to depression.

Only those who have had an over-all view of American industry at war can appreciate the advance that has been made. All industry has placed at the disposal of the government and war agencies its most valuable asset: research knowledge.

The war has taught us that when all our citizens concentrate on a common objective and cooperate toward its accomplishment, wonders can be accomplished. If that can be done for the negative purpose of war, it can also be done for positive purposes dealing with the welfare of our people. Some ten million of our youth will return to us with the resolve that somehow the possibility that such wars can be started shall be prevented. But the memory of man is short and strong emotions are soon dulled with time. There is only one effective approach to the solution, and that is to use the unemotional research technique on the social menace of war.

Our returning youth will want peace and security for some time to come. It is our function to plan it for them. They will want a chance to finish their education and to be established in business.

Chemicals....

A WAR BIRD'S VIEW OF STAUFFER CHEMICALS ··· *IN ACTION!*

Official U. S. Coast Guard Photo

Look at Stauffer Chemicals through the eyes of our fighting men. Into these ships, planes and lighter-than-air craft have gone Stauffer Chemicals—the materials of which they are made, the fuel which powers them, the uniforms on the crews who man them. In all these capacities Stauffer has served. It has been Stauffer's privilege—as well as its duty—to join in the deafening roar that is American industry at war. And after victory, it will be Stauffer's privilege to join in the overwhelming effort that will be American industry helping to rebuild America and the world.

STAUFFER PRODUCTS

*Aluminum Sulphate	Caustic Soda	Nitric Acid	Sulphur Chloride
Borax	Citric Acid	Silicon Tetrachloride	*Superphosphate
Boric Acid	*Copperas	Sodium Hydrosulphide	Tartar Emetic
Carbon Bisulphide	Cream of Tartar	Stripper, Textile	Tartaric Acid
Carbon Tetrachloride	Liquid Chlorine	Sulphur	Titanium Tetrachloride
	Muriatic Acid	Sulphuric Acid	

(*Items marked with star are sold on West Coast only.)

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Stauffer CHEMICALS SINCE 1885

STAUFFER

AMERICAN ROLLING RING CRUSHERS

- COMPACT
- EXTERNALLY ADJUSTED
- EASILY ACCESSIBLE

Why you get Splitting Action instead of Crushing . . . the patented reversible manganese STEEL SHREDDER RINGS . . . found only in the AMERICAN Rolling Ring Crusher—

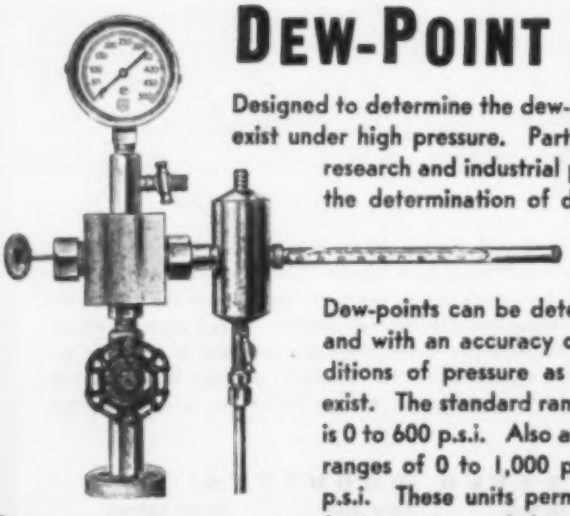
The Rings have twenty cutting edges or teeth and are designed to maintain their outward position by centrifugal force at specific speeds. In contact with solid metal the rings are momentarily deflected from their usual course because they are free to swing back out of position. No shear pins or other safety devices that require attention.

• Many of the largest and best known process industry plants are making each production hour count to its fullest with AMERICAN Rolling Ring Crushers for grinding, pulverizing, and reducing chemical raw materials of all kinds. They get more tonnage per hour, more uniform product, minimum of fines, no slivers or chips, and all this with lower power consumption, lower installation costs, and lower maintenance requirements. Let AMERICAN engineers recommend the equipment and method best suited to your needs—we maintain a testing plant for prospective users —avail yourself of this service.

• *Originators and Manufacturers of Ring Crushers and Pulverizers*

AMERICAN PULVERIZER CO. 1119 MACKLIND AVENUE ST. LOUIS, 10, MO.

DEW-POINT TESTER



Designed to determine the dew-point of gases which exist under high pressure. Particularly adapted for research and industrial procedures involving the determination of dew-points of gases.

Dew-points can be determined, with safety and with an accuracy of 2.0°F, under conditions of pressure as they are found to exist. The standard range of this apparatus is 0 to 600 p.s.i. Also available for pressure ranges of 0 to 1,000 p.s.i. and 0 to 3,000 p.s.i. These units permit easy dismantling for inspection and cleaning.

Can be provided with Yel-O-Bak thermometers for determining dew-point temperatures as low as —100°F.

Unit is sold complete with hardwood carrying case, adjustable field tripod, copper tubing and necessary fittings.

WRITE FOR BULLETIN NO. 30

THE REFINERY SUPPLY CO.

621 E. 4th St. TULSA 3, OKLAHOMA Ph., L. D. 581

Many will need rehabilitation. They will not be satisfied with generalities regarding plans for the future world—they will be critical and impatient with demagogy and political suavity. Will we be prepared to meet this demand? Will we know where we want to go and how we propose to get there? Will we have a road map ready and transportation available? That research is in our hands.

P. R. Cassidy, Babcock & Wilcox Co., before Hartford Steam Boiler Insurance Co., Inspectors, New Orleans, La., March 12, 1945.

ROTARY LIME KILN OPERATION

Purpose of a lime recovery system in a sulphate mill is to convert calcium carbonate sludge formed in the causticizing process to active calcium oxide as economically as possible from the standpoints of raw material and operating cost.

Lime sludge from the causticizing process, after it has been washed in a Dorr clarifier, is pumped to a vacuum filter for further washing and thickening, from here it is fed into the kiln by means of a screw conveyor.

One of the principal problems confronting the lime recovery operation is the formation of rings in the kiln. As is known, a ring is a doughnut like formation somewhere near the midsection of the kiln formed by adhering of lime to the walls of the kiln at that point. As operation proceeds, the ring either falls out or builds up to such an extent that production is impaired. The tendency for ring formation in a lime kiln appears to be a function of the ratio of surface to mass, which ratio is, of course, a function of particle size. In other words, the larger the particle size at the point of the ring zone less will be the tendency for ring formation.

Wet sludge, as it dries out, forms both dust and pellets. The pellet size will not adhere to the walls of the kiln, while dust will invariably do so if in proper contact of the wall at the proper temperature.

Calcium carbonate sludge fed to a lime kiln contains varying amounts of alkali. The amount of alkali may be varied by varying the degree of washing. For satisfactory operation it is believed that the soda content in the sludge should be as low as possible, not over 1.0 percent as Na_2O. Lime sludge, with a high soda content is poor practice as this has tendency to both form rings and leach out the kiln liming.

Free lime in the sludge seems to influence the ringing characteristics. In general, it is safe to say that free lime, even in small amounts, will help to increase the proportion of pellets formed, which fact is indicated by a slight reduction in dust carry-over, as shown by the amounts of dust collected in the stack dust chambers. It must be remembered, however, that carrying an excess of free lime in the sludge increases the oil consumption and reduces efficiency.

It is recommended that: Lime sludge to the kiln be washed as free of soda as possible; consistency of the sludge to kiln be kept between 50 and 55.0 percent, (moisture-free basis); free lime in the sludge maintained between 3.0 to 5.0 percent; constant rate of feed to the kiln

NUMBER 2

PROPERTIES WHICH MAY SUGGEST NEW APPLICATIONS OF SONNEBORN PETROLATUMS

(Soft Type Micro-Crystalline Waxes)

IN YOUR PROCESSING OR MANUFACTURING OPERATIONS

The benefits you can obtain by the use of Sonneborn Petrolatums are suggested by the partial list of properties at the right. (Other properties were presented in an earlier issue.) Constantly broadening usage of these soft-type micro-crystalline waxes indicates that the applications are almost limitless.

In contrast to paraffin wax, which forms crystalline aggregates, petrolatum is amorphous, or, in a stricter sense, micro-crystalline. Its internal phase comprises *liquid* hydrocarbons and the external phase comprises *solid* hydrocarbons.

Sonneborn Petrolatums are readily available in three types — FONOLINE (soft), PROTOPET (medium soft), and PERFECTA (medium soft with high melting point). They are refined in a range of colors to suit various industrial purposes. Special types can also be made to individual specifications.

Sonneborn Petrolatums offer many interesting possibilities. Have our Department of Industrial Research tell you how one of these products can help you solve some current or future problem.

★ ★ ★

This is the second of two bulletins focusing industry's attention on the possibilities of Sonneborn Petrolatums for various processing or manufacturing operations. Reprints of the series will be supplied on request.

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should be maintained, established by the speed of the kiln; chain section temperature kept between 525 and 400 deg. F. to maintain the lime temperature between 2,000 to 2,200 deg. F.

E. A. Harper, Brunswick Paper Co., prepared for presentation before Technical Association of the Pulp & Paper Industry, New York, Feb. 19–22, 1945.

UNDESIGNED POWER PLANTS

Barely 10 percent of the power plants of the nation burn a wide range of coals with a high degree of satisfaction and efficiency. The boiler plants of America, which are virtually the heart of its industrial system, on the whole are not good. Surveys made from the coal burning standpoint, involving several thousand boiler plants, and many fuel conferences for the better utilization of coal, attended by hundreds of industrial consumers, have yielded unmistakable proof that most plants are obsolete and that insufficient knowledge of vital fuel and combustion factors is reflected in their original design.

The power and larger heating plants of the country can be roughly grouped, fuelwise, into three categories: 10 percent which function with high efficiency, 50 percent which do not burn any type of coal satisfactorily and with good efficiency, and 40 percent which burn a very restricted range of coals with varying degrees of satisfaction and efficiency.

Part of the reason for this great inefficiency is because the plants were not designed, but the component elements simply purchased from different sources and erected. Among the other factors are lack of fundamental information on coals and their availability, keeping down costs, wrong selection of equipment, destructive competitive bidding, divided responsibility, improper coordination of boiler, furnace and stoker or pulverizer, excessive overloading, etc.

Of all the mistakes made in the past in the design of boiler units, the most common and most serious was the failure to allow a reasonable factor of safety in respect to ash fusion temperature. Ash fusion is the most vital factor in furnace and stoker design. The fusion curve is going downward each year because of the faster exhaustion of the limited reserves of higher fusion coals.

J. E. Tobey, Fairmont Coal Bureau, before American Society of Mechanical Engineers, New York, Feb. 6, 1945.

METAL POWDERS BY FUSED SALT ELECTROLYSIS

Recent far-spread interest in powder metallurgy has suggested the production of relatively pure metal powders or metal-alloy powders by the fused electrolyte method. The three major metal products of the fused electrolyte industry are sodium, aluminum, and magnesium. In each case the temperature of the fused salt bath is decidedly above the melting point of the metal produced. Accordingly all three metals are removed from the cells in liquid form. But when fused salt electrolyses are carried out at a temperature above the melting point of the electrolyte but below that of the metal to be deposited at the cathode, we obtain, at high cathode cur-

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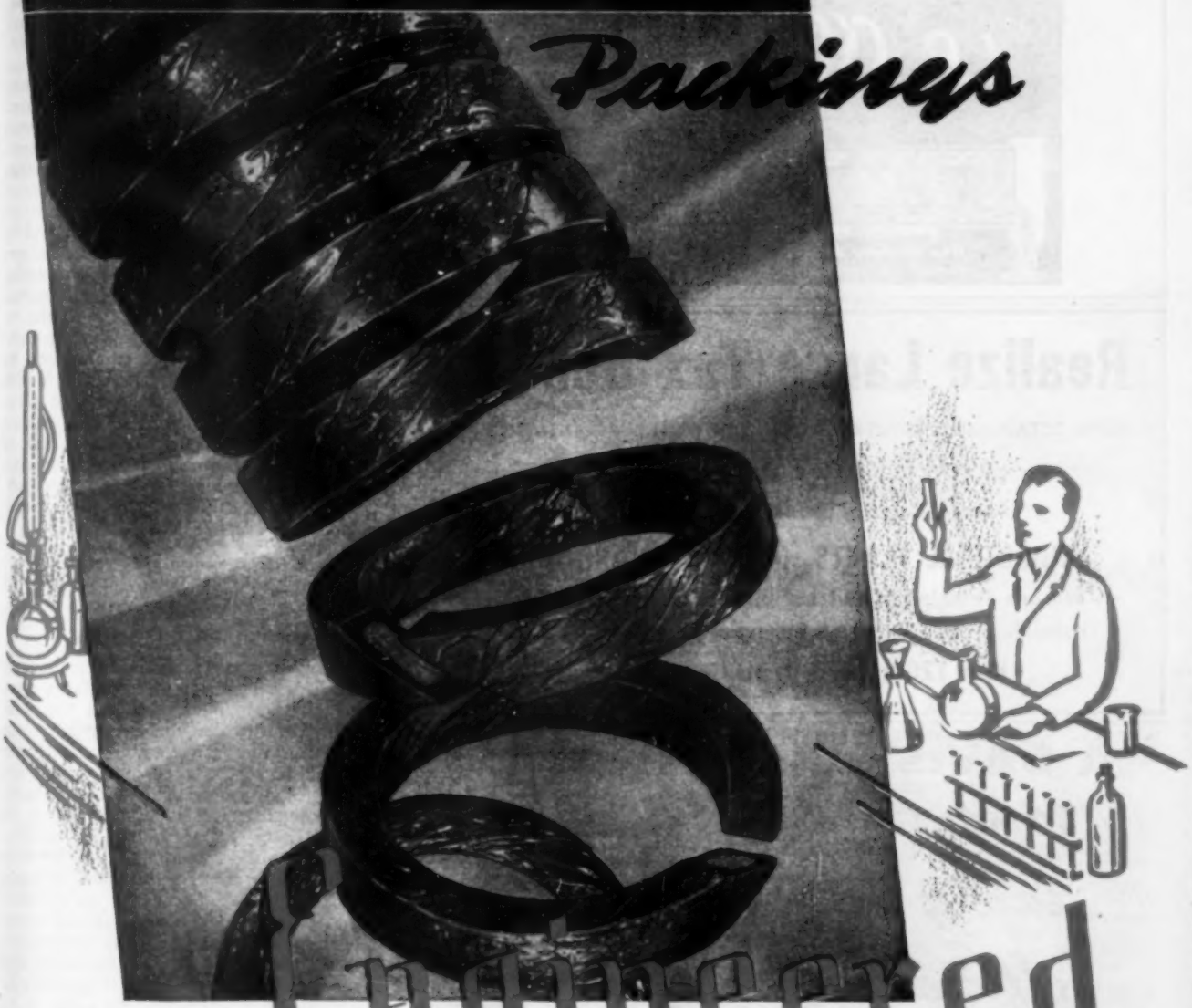

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rent densities, a deposit of metal dendrites, interspersed with electrolyte. This method has been used in the past with baths constituted of halides, borates, phosphates, etc. for the production of thorium, uranium, tantalum, cobalt, nickel, iron, copper, zirconium, silver, platinum, beryllium, molybdenum, tungsten, chromium, and aluminum. The advantages of this type of electrolysis are lower operating temperature and the resulting reduced power consumption; the winning of metals far below their melting point; and operating at relatively high current densities since the fine crystals covering the face of the cathode present a relatively large actual surface. Refining can be accomplished by using soluble anodes. The disadvantages are the difficulties encountered in removing the deposits from the cell, the elimination of the entrapped electrolyte, and the reaction of air and moisture with the bath.

In the typical case of refining iron by anodic dissolution in an alkali chloride bath, carbon, sulphur, silicon, and phosphorus are eliminated. The iron product obtained is very pure, soft, and free of nitrogen and hydrogen. It is dense, sharp-edged, free-running, and of grain size, suitable particularly for powder metallurgy.

W. J. Kroll, consulting electrometallurgist, paper prepared for presentation at 87th general meeting of The Electrochemical Society, Atlantic City, April 12-14, 1945.

PERSONNEL PROBLEMS

Points to be kept in mind when making a selection of personnel for industry are a man's general intelligence and the possibility of his development over a long period in the right atmosphere. Interviews should be kept as informal as possible and the greatest pains should be taken to make the candidate feel at his best and at his ease. Every endeavor should be made to find out his likes and intellectual interests. The greatest allowances should be made, especially at the present time, for the effect of the war upon his educational career; and at all times the most sympathetic allowances should be made for a man who has not had much chance of general education and experience of the world in his youth. Within industry itself, every possible effort should be made to encourage scientific and intellectual enthusiasm. When possible the stimulus of travel and visits to scientific and technical conferences should be used. The man in industry should be encouraged to be on particularly good terms with people in that branch of science in which he is engaged who are in the universities.

Men whose performance in university examinations had been poor should not be overlooked, as there might be some good reason for this. Generally speaking, people who did well in examinations were industrious and they may very well have brains, but occasionally success in them proved to be no more than a feat of memory. The selection work of psychologists in this war is to be commended and every encouragement should be given to them to assist in similar problems for industrial recruitment. Crux of the whole matter was to regard a man's education as having for its purpose "getting him into a frame of mind where he will go on building up on himself for

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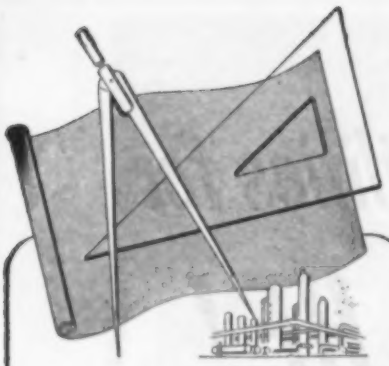

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the rest of his life, or in other words his degree is merely an incident in his upward flight." The other end of the scale is the man who on obtaining his degree, says: "I'm qualified," and potters along till he reaches his grave. A man is not a kind of *doctor mirabilis* when he has graduated. There should be more training in the writing of clear English, particularly for those who have to present reports and appreciations of other people's work.

F. A. Freeth, Imperial Chemical Industries, Ltd., before The Institute of Physics, London, Dec. 2, 1944.

WHY RESEARCH?

EXPERIMENTAL approach to knowledge and its application has been the function of research, and as related to industry may involve an improvement in quality, a lowering in cost or the introduction of a new invention to satisfy a need. By the study of the properties of its products, industrial research strives to expand their usefulness into new fields or to displace something not as useful. For example, dimethyl phthalate, a good plasticizer, has been found to be also an insect repellent. The antifreeze solution which contained alcohol is being displaced by a solution containing ethylene glycol.

It is customary these days to boast of the marvelous accomplishments of our age in science and industry, and, in so doing, we are prone to underestimate the debt we owe to our predecessors, who not only developed the fundamental concepts, but also directed our thoughts into productive channels. It behooves us, then, to remember that progress is a continuing activity and that unborn generations will derive their stimulus from some of our own discoveries. Upon our works they will build even more imposing structures.

But today what force is it that prods us on to new discoveries? It has been said that the accelerated pace of physical progress is motivated by the prospects of material gain; and although it is true that in industrial research personal gain is the measure of the utility of the accomplishments, still it cannot be denied that the ultimate goal of our desire is the betterment of society.

Lucas P. Kyrides, Monsanto Chemical Co., Midwest Award Medallist, before St. Louis Section, American Chemical Society, St. Louis, March 5, 1945.

INDUSTRIAL ELECTRONICS

MAJOR difference between communication electronics and industrial electronics is the heavy emphasis which is placed on all costs in the industrial field.

Operation of industrial electronic equipment, the personnel who must install, operate, and service it, and the economics which govern its design and construction vary somewhat widely from that found in the communication field. In the latter field, there are no practical substitutes. However, many of the industrial tasks done by electronic equipment can be done by other means. Such simple tasks as counting, sorting, inspecting, synchronizing, and regulating can be readily done by semiskilled, and in many cases by totally unskilled, operators. Also, motors may be controlled by rotating machinery and electromagnetic means, some resistance welders may be

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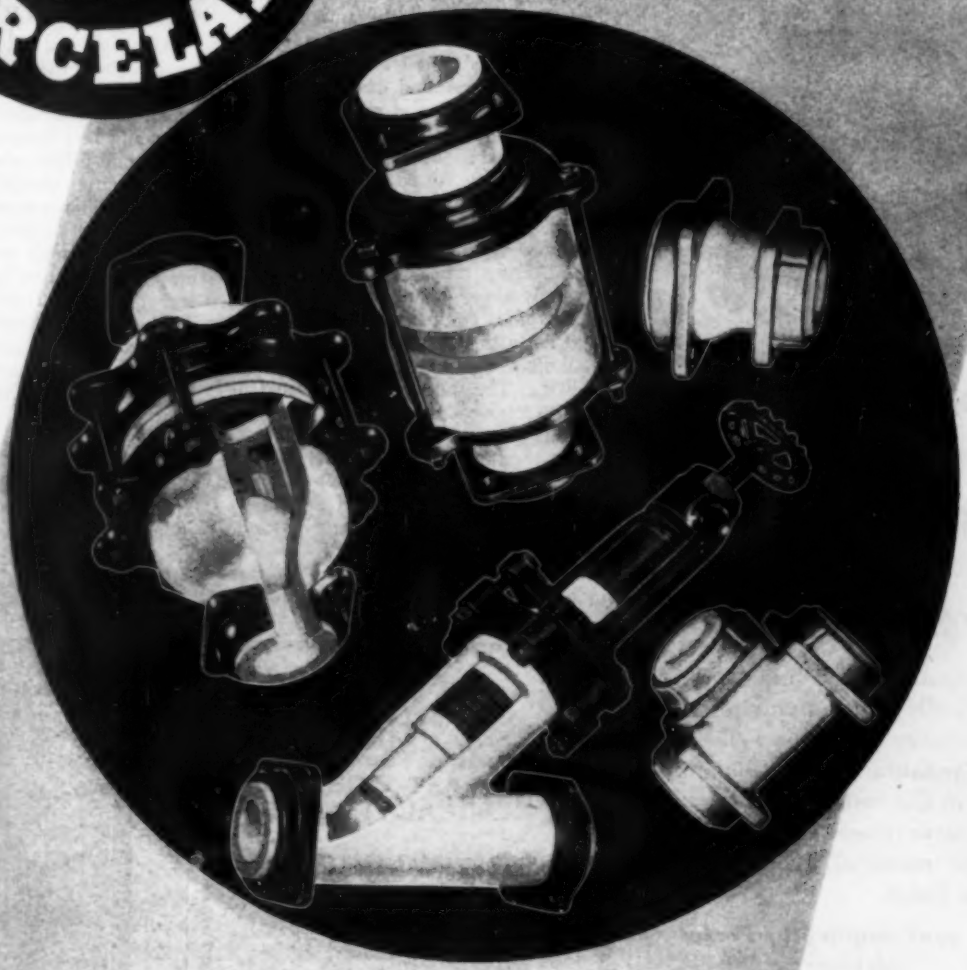

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timed by mechanical means, and alternating current may be rectified to direct current by a number of methods.

Therefore, to hold its own in the industrial field electronic equipment must either do a job more economically than it can be done by other means, or it must do it so much better that the additional cost will be justified.

Industrial electronic equipment ranges in size from the large rectifier installations which convert literally hundreds of thousands of kilowatts of power to the small "electric-eye" unit and the timing relay. Of necessity, then, electronic equipment must be built so that it can be easily installed and serviced, and designed so that it will operate safely and efficiently under various conditions imposed by location and careless or inexperienced personnel.

Electronics was forced to grow up in a period during which money was scarce, labor plentiful, and the general attitude toward new and untried devices extremely skeptical. For a time, its progress was discouragingly slow. Then, finally, one type of electronic equipment after another proved its intrinsic worth and other, more complicated equipment gradually came into being. The war indirectly assisted industrial electronics. The demand for planes gave added impetus to electronic resistance welding, the increasing ue of machine tools provided a wide outlet for electronic motor controls, and the demand for timers, photoelectric relays, contact amplifiers, and rectifiers rapidly increased. It is expected that many present manufacturers of electronic equipment designed for war use will turn to the manufacture of industrial electronic equipment with the return of peace.

Industrial electronics represents a broad field, with ample room for all, and with the impetus provided by the war it should have a lusty future, repaying well those who will study it seriously and do their part to help build it up.

W. D. Cockrell, General Electric Co., before Institute of Radio Engineers, New York, Jan. 24–27, 1945.

PLASTICS APPLICATIONS

IMPROPER and indiscriminate use of plastics can check the postwar expansion anticipated for that industry. The only factor which may retard the growth of this industry would be the misuse of plastics or the use of one plastic where another of different properties should be used, or the use of plastic when a metal or alloy would have given better satisfaction. The purchaser of plastics articles should determine what properties, such as impact strength, color, and dimensional stability, are requisite. Then the plastic which most nearly meets the specifications should be selected.

There is no plastic that fits all uses. Buyers should keep abreast of new developments constantly being made in the field since substantial sums are being spent in research, not only for the development of new plastics but also in the improvement of existing materials and of methods of use.

E. W. Cronin, E. I. du Pont de Nemours & Co., before Chicago Purchasing Agents Association, Feb. 8, 1945.

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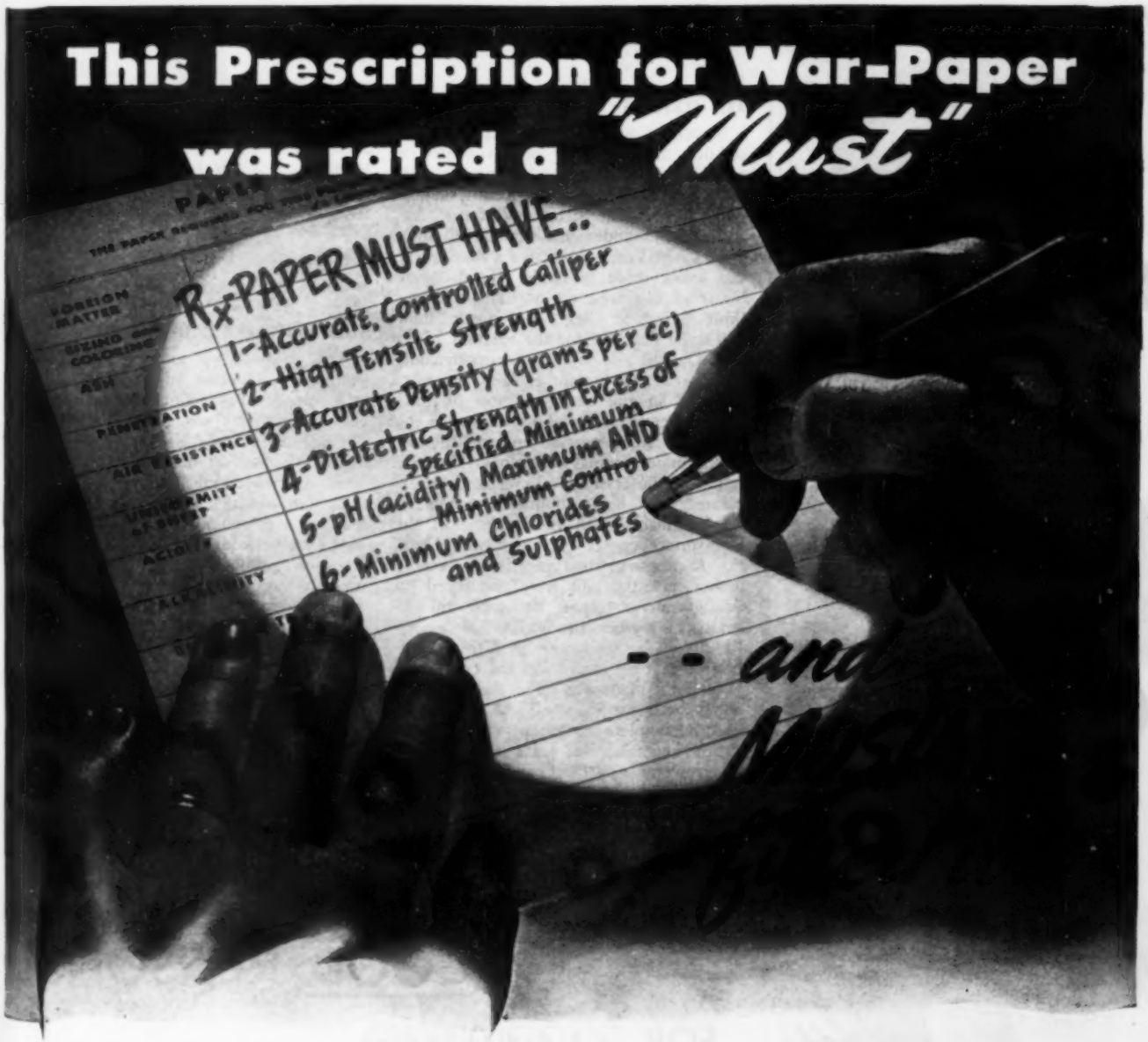

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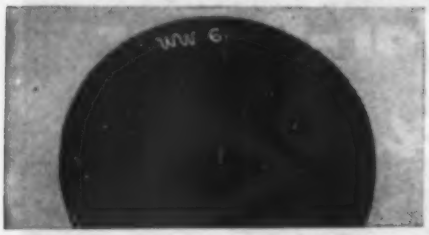

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FOREIGN LITERATURE ABSTRACTS

TIN OXIDES

RESEARCH work was conducted on the stability and volatility of tin oxides, a subject that had received almost no attention although it is of great practical significance in the metallurgy of tin. Analysis of thermodynamic data on Sn-SnO-SnO_2 showed the existence of a zone where the lower oxide is stable. Temperature limits of this zone are as follows: lower limit 320 ± 50 deg. K., upper limit 650 ± 20 deg. K. (for the reaction $2SnO = SnO_2$ (sol.) + Sn). A thermodynamic diagram of this system explains the facts observed in the decomposition of SnO at high temperatures and coordinates the values of free energies and of thermal effects under normal conditions. Decrepitation of the crystalline lower oxide is explained as a non-equilibrium process related primarily with the decrease of the free surface energy of liquid tin. Using the Kundsen method of effusion, experimental investigations were conducted on equilibrium of liquid tin with tin dioxide at a temperature of 700-900 deg. C. Results of this work were used for calculation of vapor pressure and the entropy of gaseous tin monoxide. The thermal value of the entropy $S°_{298.1} = 55.88 \pm 1.0$ I.U. was in complete agreement with the statistical one calculated from molecular and spectroscopic constants 55.52 ± 0.2 I.U. These results have been used in technological practice. Tables of calculations made it possible to project the mechanism of the first stages of the reduction of cassiterite at high temperature and to determine conditions for reducing losses of tin in processing. Evaporation of tin at high temperatures is due to volatility of gaseous tin suboxide.

Digest from "Stability and Volatility of Tin Oxides" by V. K. Vesselovsky, *Zhurnal Prikladnoi Khimii*, XVI, No. 9-10, 397-416, 1943. (Published in Russia.)

SULFATHIAZOLE DRUG

THE COMMONLY known sulfanilamid compounds, sufidine and sulfazole, used in treatment of infectious diseases, especially pneumonia, are toxic, whereas 2-sulfanilamidothiazole is less toxic and yet highly effective. A method has therefore been developed for the preparation of sulfathiazole which is suitable for industrial use. 2-Aminothiazole, unlike its isolog 2-aminopyridine, has received little attention although it has many possible uses in various syntheses. Experiments were therefore conducted to learn more about this interesting aminocompound. All methods used were based on condensation of thiourea with certain halogen derivatives. The chlorinated derivatives necessary for the synthesis of 2-aminothiazole can be prepared by chlorinating ethyl ether, ethyl alcohol and ethyl acetal. The object was to attain constant results so the method could be used commercially. Optimum conditions for preparing the

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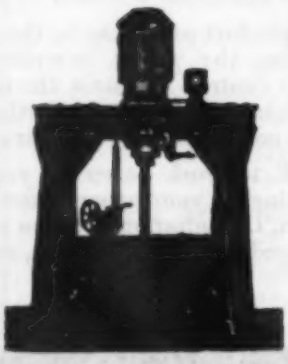

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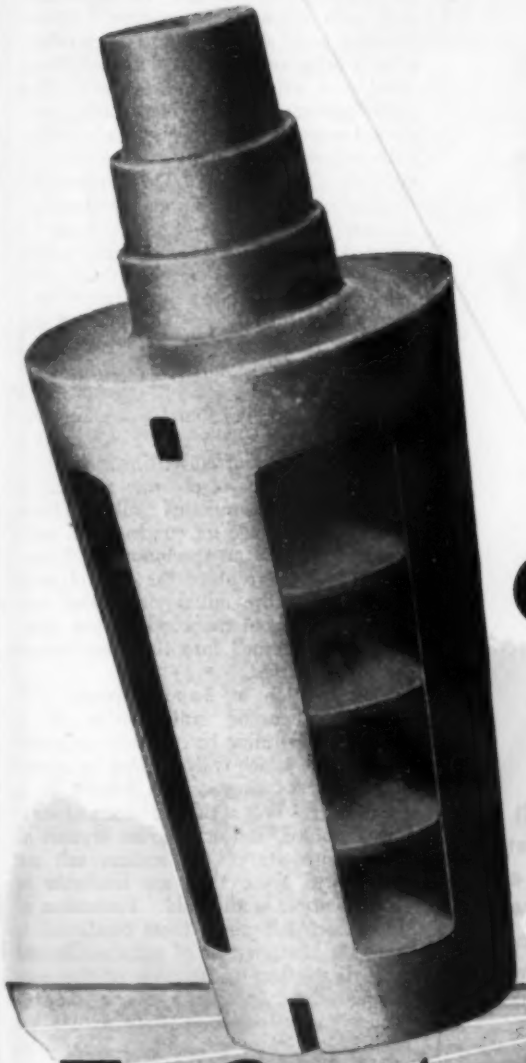

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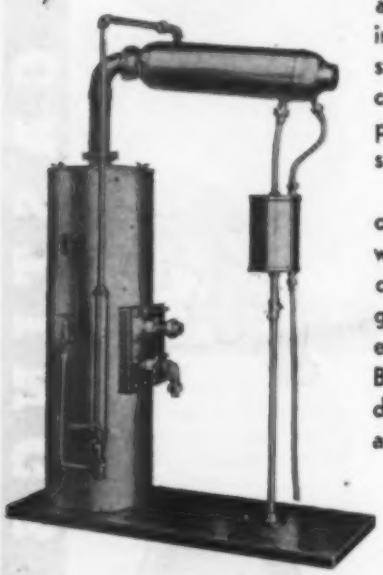

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chloro-derivatives suitable for condensation with thiourea to produce 2-aminothiazole were determined. Chrlorination of pure ethyl acetal to beta-chloracetal was considered especially interesting. The crude product from the chlorination condensed with thiourea to give 2-aminothiazole hydrochloride with a constant high yield of 80-82 percent. This method for obtaining the hydrochloride of 2-aminothiazole is very simple but cannot yet be adopted widely because pure ethyl acetal, the raw material, is not commercially available, although there are many possibilities for its industrial production. One of the raw materials for this purpose is alkyl vinyl ethers which have now become available through the work of E. E. Favorski and his colleagues. Especially interesting results were obtained by utilization of alkyl vinyl ethers without converting them into acetals. Additions of chlorine resulted in alpha, beta-dichlordiethyl alkyl ethers which were suitable for condensation with thiourea, without any preliminary purification. 60-70 percent of the alcohol used for obtaining the initial vinyl ether can be recovered from the condensation operation and returned into the manufacture of the vinyl ether.

Condensation of 2-aminothiazole with n-acetaminobenzene sulfochloride in a medium of pyridine bases results in acetyl sulfathiazole which is hydrolyzed by means of 12 percent caustic soda heated on a water bath. When the dark-colored solution is cooled, almost colorless crystals of the hexahydrate of the sodium salt are precipitated since they are insoluble in alkali solution in the cold. Formation of the sodium salt under these conditions is especially characteristic of sulfathiazole and greatly facilitates preparation of the pure compound. The sodium salt is recrystallized from water as snow-white crystals and is suitable for use as a water-soluble form of sulfathiazole.

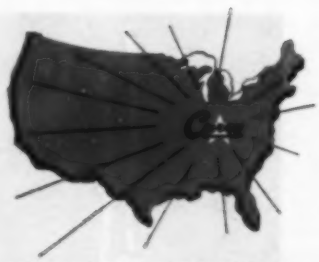
Digest from "Preparation of 2-Aminothiazole and 2-Sulfanilamidothiazole" by I. J. Postovsky, V. I. Hmelevsky and N. P. Bedniagina, *Zhurnal Prikladnoi Khimii*, XVII, No. 1, 65-75, 1944. (Published in Russia.)

POTASSIUM DETERMINATION

A NEW gasometric method for the determination of potassium has been developed which is based on its precipitation as a cobaltinitrite, followed by alkaline hydrolysis and action of sulphamic acid (Raschig reaction) on the liberated nitrite groups. Six molecules of nitrogen correspond to two atoms of potassium.

After the eventual elimination of the metallic and ammonium ions, the reaction was brought about by pouring the sample into a conical centrifuge tube and adding a large excess of reagent which was obtained by dissolving 0.20 g. of sodium cobaltinitrite in 1 cc. of 1 percent acetic acid (30-50 times more than necessary for the formation of the complex ion). After standing 30 to 60 min., it was centrifuged, decanted by siphoning, again put in suspension and washed with 4-5 cc. of the following liquid: 1 cc. of acetic acid, 65 cc. of water, 35 cc. of alcohol and a few drops of octyl alcohol. After decanting, hydrolysis, treating with several cc. of 5 percent sodium phosphate, keeping it 5 min. on a

Where BTU's go AWOL



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boiling hot water bath, the cold liquid was poured over a ureometer, washed with 2-3 cc. of 1/5 N sulphuric acid and treated with an excess (10 times) of sulphamic reagent obtained by dissolving 0.1 g. of sulphamic acid in 2 cc. of water. Finally, the liberated nitrogen must be determined, making the corresponding corrections in pressure and temperature. Good results are obtained both in micro and macro-analysis.

Digest from "New Gasometric Method for Determination of Potassium" by M. Cambon, *Bull. Soc. Chim. de France* 700, 8, 1941. (Published in France.)

BRAZILIAN MANGANESE

BRAZIL is one of the countries which export high quality manganese. There are numerous deposits throughout the center of the state of Minas Gerais, principally in the regions of Lafayette, Ouro Preto, Itabira, Pitangui, D. Silverio (Saude), Sao Joao d'el Rei and Lavras. The state of Baia also has small deposits in Nazare, Bomfim and Jacobina. There is a large deposit in Urucum in the state of Mato Grosso. A number of promising deposits are also being developed.

Brazilian manganese varies in quality and type. The more concentrated types, above 48 percent and with less than 7 percent iron come from the state of Minas Gerais, principally from Lafayette and from Saude, and Santa Barbara. Baia has produced a little more than a thousand tons per month of over 50 percent manganese. Some exceeded 52 percent. Urucum has the largest known reserve with a mineral of over 46 percent manganese. Brazil also has a reserve of 40-44 percent mineral in the regions of Sao Joao d'el Rei and others, as well as 35-42 percent types which are not worth exporting. The ferro-manganese types, rich in iron and suitable for preparation of spiegeleisen, have also been exported from time to time.

Digest from "Manganese," *Brazil 1942, Mineral Resources*, Bull. No. 56, 34, 1943. (Published in Brazil.)

ARSENIC ANALYSIS

APPLICATION of liquid amalgams to the chemico-analytical determination of arsenic compared favorably with the old method. Heating above 60 deg. C. was accompanied by increased liberation of hydrogen, and paper saturated with mercuric chloride was colored at a faster rate. Increase of the temperature to 95 deg. C. did not lead to reduction of the sulphuric acid to hydrogen sulphide as in the usual method where hydrogen sulphide begins to form even at 30 deg. C. No noticeable loss of arsenic was observed on heating hydrochloric acid solutions. The only objection to the amalgamic method for arsenic is the rising humidity of escaping gases, as a result of which the coloring of the paper does not last long although it is very intensive. The coloring becomes normal, however, when the gases are dried.

Digest from "On the Application of Liquid Amalgams in Analytical and Preparative Chemistry" by V. D. Ponomarev, *Zhurnal Prikladnoi Khimii*, XVII, No. 3, 151-155, 1944. (Published in Russia.)

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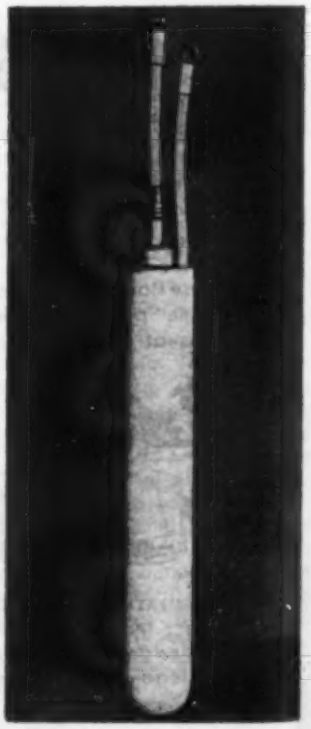

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CHEMICAL ENGINEER'S BOOKSHELF

LESTER B. POPE, Assistant Editor

Automatic harvester at work in a field of sugar cane

SUCROSE PRODUCTION

CANE SUGAR HANDBOOK. *By Guilford L. Spencer and Geo. P. Meade. Published by John Wiley & Sons, New York. 834 pages. Price $7.50.*

Reviewed by Gustave T. Reich

IT IS inconceivable that a chemist or engineer connected with the sugar industry would be found without "Spencer and Meade." Therefore the fourth edition will be welcomed by this industry. This edition is up-to-date and authoritative, having had collaborators such as Peter Honig, Alfred L. Webre, T. G. Davis and Wm. L. Owen.

While the arrangement of this book is similar to the third edition published in 1929, its subject matter has been increased from 560 to 834 pages. Likewise the number of figures increased from 136 to 206.

Subject matter is divided into three parts: the manufacture of raw sugar, sugar analysis, chemical control of the factory and reference tables. Under the first subdivision the titles of the chapters are: economic phases of the sugar industry, raw material, extraction of the juice, steam plant and fuel, outline of manufacturing raw cane sugar.

Other chapters deal with the purification of the juice, treatment of scums and clarified juice, chemical reagents used in sugar processes.

Excellent charts and calculations are incorporated in chapters on evaporation and heating, crystallization of the sugar and in the chapter on crystallization in motion. The remaining chapters of the first part cover preservation of the juice and sirup during shutdowns, purging, packing and warehousing the sugar, blackstrap molasses and edible sirups.

Refining of the sugar is covered in the following chapters: keeping and refining qualities of raw sugar, sugar refining, describing the hot-mingling affination process. Analytical and chemical control methods are brought up-to-date, especially the examination of refined sugars, better color control, turbidity and ash. Reference tables covering 131 pages make this book a complete sugar compendium.

The authors are to be congratulated on the presentation of this work. It is well printed, very attractively bound and will be of great assistance to those engaged in the practical work of manufacture of carbohydrates.

PRESERVE RESERVES

PEACE, PLENTY AND PETROLEUM. *By Benjamin T. Brooks. Published by Jaques Cattell Press, Lancaster, Pa. 197 pages. Price $2.50.*

Reviewed by Blaine McKee

THE United States is in a critical situation in regard to its oil supply. Instead of being blessed with an endless amount of petroleum, we are rapidly depleting our reserves. Since 1937, the new discoveries have fallen so sharply, that in 1942, they amounted to about 20 percent of the total production, although the number of new wells drilled had increased one third during the same time. Yet, to continue as a world power, our country must have an adequate supply of petroleum. Without it, our transportation system would be handicapped, our production curtailed, and our army, navy, and airforce unable to carry the war to distant shores. In his book, "Peace, Plenty and Petroleum," Mr. Brooks examines our present position and then offers a solution to overcome our inevitable shortage of petroleum. To meet our future needs, he discusses two possibilities, the manufacture of substitutes, and the importation of foreign oil. Because of the higher cost of substitutes, he favors importing oil, although much of this oil is controlled by other countries. He believes the government should protect and encourage our large oil companies in gaining foreign concessions without, however, governmental control of these companies. But these oil companies will have to operate within any international agreements reached between the United States and Great Britain, and possibly Russia, concerning petroleum.

This book is not mere opinion, but is backed by authoritative charts and tables, and in an interesting, readable manner, tells the story of the petroleum industry from its beginning until the present. It will be equally enjoyed by the technical man and the layman, both of whom need information about this important raw material. Whether or not we agree with the author's solution, we must realize that he has had wide experience in the oil industry at home and abroad, and his conclusions are worthy of consideration.

MOST DEADLY SPECIES

THE BUREAUCRAT. *By John H. Crider. Published by J. B. Lippincott Co., Philadelphia. 373 pages. Price $3.*

Reviewed by S. D. Kirkpatrick

DONALD KEYES likes to pose as a Washington bureaucrat whose principal problem is trying to get along with other Washington bureaucrats. Actually, of course, that is not the case, for by his own admission he effectively eliminates himself from the deadly biological species so faithfully described by John Crider in this most readable and entertaining book. Here one of the most talented of our contemporary journalists takes time off from his daily duties in the Washington Bureau of the *New York Times* and amuses himself by recounting many of the apt and funny stories that characterize the human side of bureaucracy.

Crider puts the species under the microscope and proves conclusively that although conforming in other respects to the laws of nature, the bureaucrat defies evolution. He is the same today as he was in ancient Rome, in Sparta, or in Dickens' day in England, "spinning his

RECENT BOOKS RECEIVED

Discovery of the Elements. 5th ed. By M. E. Weeks. Journal of Chemical Education. $4.

Flavor. By E. C. Crocker. McGraw-Hill. $2.50.

German-English Dictionary of Metallurgy. By T. E. R. Singer. McGraw-Hill. $4.

Industrial Electric Furnaces and Appliances. By V. Paschkis. Interscience. $4.50. Vol. I.

New World of Machines. By H. Manchester. Random House. $3.

Principio to Wheeling. By E. C. May. Harper & Brothers. $3.

Prosperity: We Can Have It If We Want It. By M. Shields & D. Woodward. McGraw-Hill. $3.

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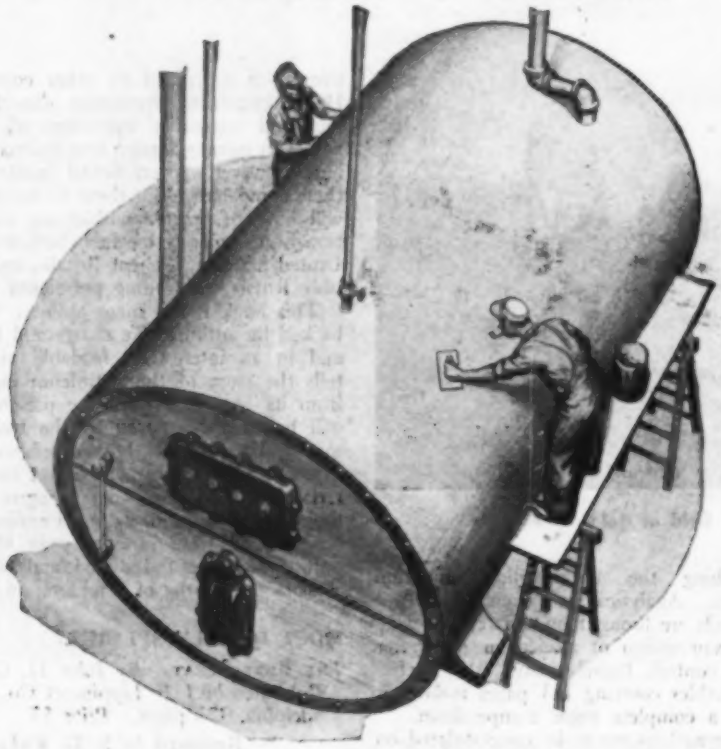

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endless webs of red tape without regard to time or clime or calendar." He is the hardy perennial that always survives the last war to become more prevalent in the next. He becomes a vested interest that could very well threaten the future of democracy. In fact, that is the most serious challenge that comes out of this presentation of seemingly unrelated incidents and anecdotes.

In plan, the author first discusses "The Origin of the Species"—his changelessness, his habitat, his remarkable fertility, his habits and protective coloration. Part II, "Bureaucracy of War," starts in the Washington madhouse with OPA as the prize mushroom, but not neglecting the other agencies with their senseless questionnaires and foolish memoranda—even including the WPB classic about the possible rationing of two-way stretch girdles! More serious are Part III on "Permanent Bureaucracy," and Part IV which points up the challenge as the disease spreads to state and local governments. Nor are the international implications overlooked for Mr. Crider finds that cartels which stifle competition and initiative are nearly always highly developed bureaucracies.

Here is a book that this reviewer gladly recommends to anyone who has the problem of getting along with the other bureaucrats. And who doesn't?

ENCYCLOPEDIA OF PLASTICS

PLASTICS CATALOG FOR 1945. *Published by Plastics Catalog Corp., New York. 1,178 pages. Price $6.*

SEVERAL new features appear in this year's catalog. A number of pages are devoted to the statistics of the industry, including figures for molding powder production, molding machines in use, and estimated value of 1943 output for certain companies manufacturing plastic materials. Another innovation is a list of prices of molding compounds. One section covers ASTM standards. Articles on recently developed materials include silicones, Polectron, Polyethylene, Furane resins, resorcin-formaldehyde resins. The directory section includes ten complete directories to all branches of the plastics industry including educational institutions, molders, material manufacturers, and trade names.

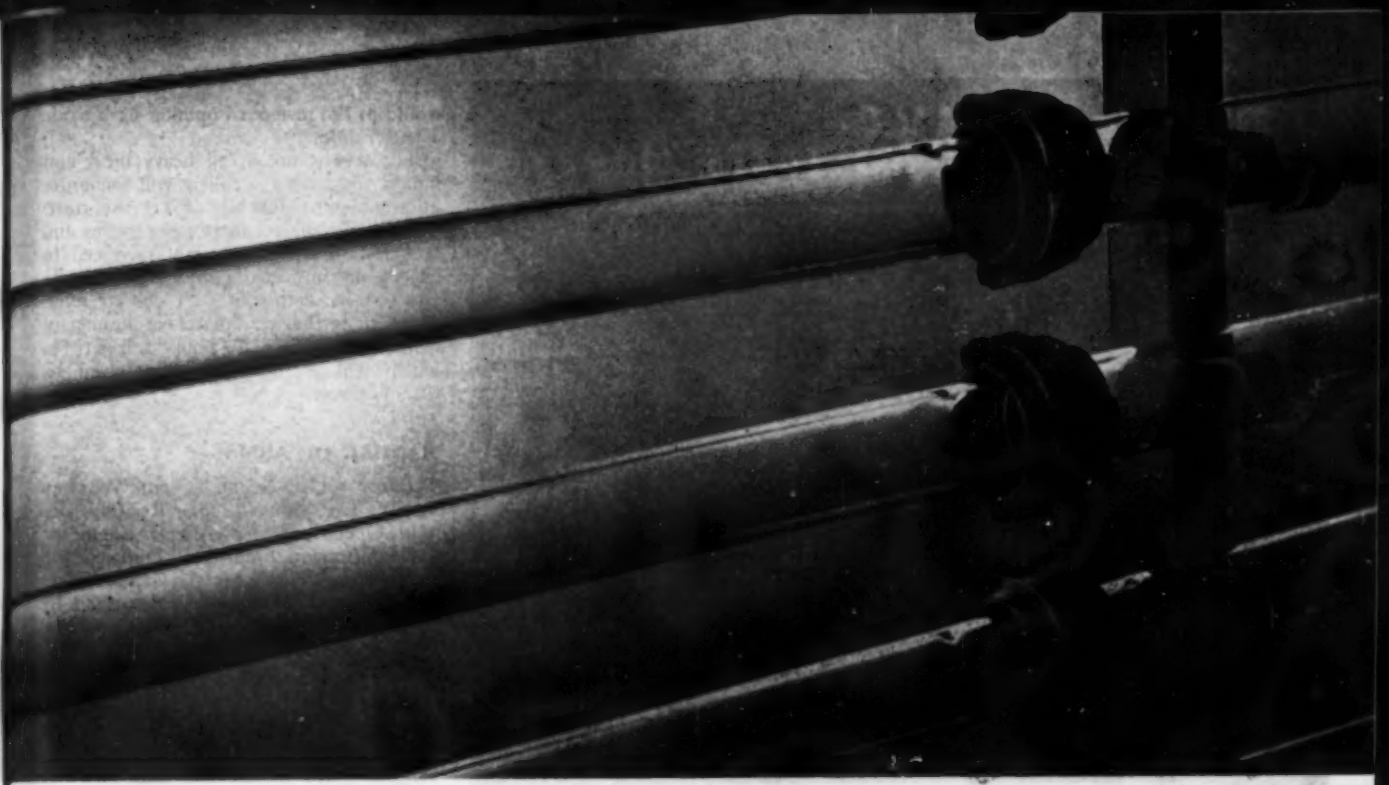
ELEMENTARY TEXTBOOK

FUNDAMENTAL PRINCIPLES OF PHYSICAL CHEMISTRY. *By Carl F. Prutton and Samuel H. Maron. Published by The Macmillan Co., New York, N. Y. 780 pages. Price $4.50.*

Reviewed by F. C. Nachod

GOAL which the authors set themselves, namely "to place in the hands of teachers and students a book which covers the fundamental principles of the subject in a thorough, sound, up-to-date and clear manner" has been reached very well. This text will make a marked impression on the reader, particularly with respect to clarity. It is primarily a school book and not so much a refresher although it may be used as such with certain limitations.

What constitutes "fundamental" principles and what does not is highly debatable and controversial. The use of "basic" or "elementary" instead of "fundamental"



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would in the reviewer's opinion have made a better title.

The text is not at all heavy meat and juniors and seniors in college will encounter no troubles or difficulties. Yet the treatment of the subject matter is rigorous and accuracy in derivation is not sacrificed to expediency in teaching. Each of the 23 chapters has a list of well chosen references for further reading and a number of working problems. A book well written which will be equally well received by the audience.

MANUAL OF ARMS

TECHNOLOGISTS' STAKE IN THE WAGNER ACT: *The National Labor Relations Act in Operation as it Affects Engineers, Chemists and Architects. Prepared and edited by M. E. McIver, H. A. Wagner and M. P. McGirr. Published by American Association of Engineers, Chicago. 272 pages. Price $2.*

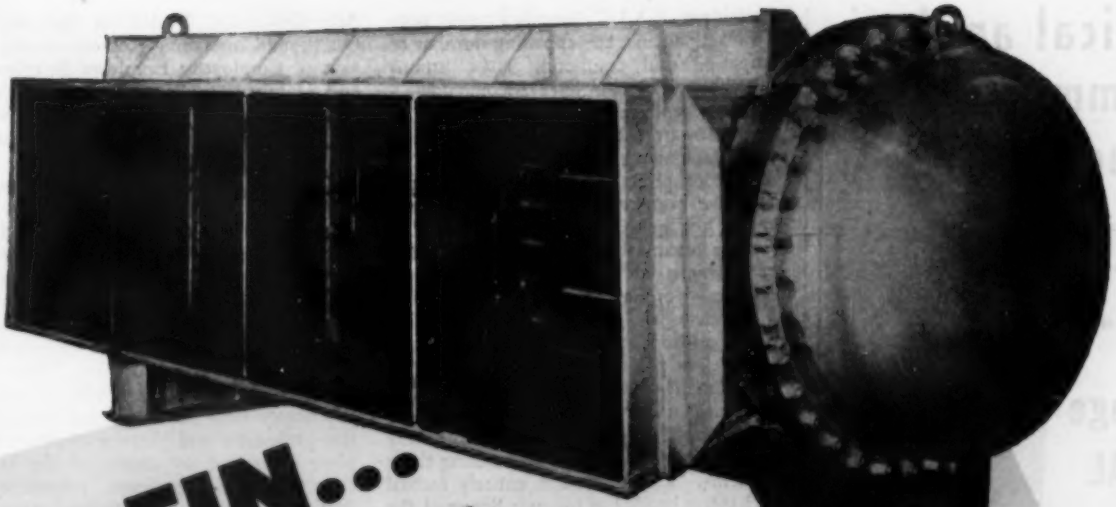
Reviewed by S. D. Kirkpatrick

MORE than twenty-five years ago the American Association of Engineers pioneered a program to promote collective bargaining for professional engineers. It helped the technical employees of the railroads to obtain well deserved pay increases and eventually to organize their own union that immediately showed its ingratitude by withdrawing all support from the Association. Engineering employers, with the none too subtle assistance of the other technological societies, dubbed AAE a "glorified labor union" and tried to relegate it to a position of questionable influence and authority. Fortunately, however, it has lived to see its principles vindicated as its former critics have turned to it for help in meeting some of the profession's most pressing problems of today.

Thanks to a few hardy souls like Secretary McIver and his colleagues, the torch has been kept burning. Through their efforts some progress has been made toward meeting the most urgent need of the engineering profession—unity in thought and action in our common concern for ourselves and our service to society. This book is an honest, unprejudiced effort to help technologists understand the advantages as well as the disadvantages that are inherent in the exercising of the rights guaranteed to them by the National Labor Relations Act.

As far as this reviewer is aware, this is the first book to confine itself exclusively to the effect of the Wagner Act on scientific and engineering workers. More than two-thirds of its pages are devoted to direct quotations from statements of the National Labor Relations Board which deal with the rights of professional workers and the conditions under which they can exercise such rights. In addition there is an appendix which includes a copy of the act and a bibliography followed by five very revealing statements prepared by the following technological societies: American Chemical Society, American Institute of Chemists, American Society of Civil Engineers, National Society of Professional Engineers and the American Association of Engineers.

Dr. Gustav Egloff, in his official capacity



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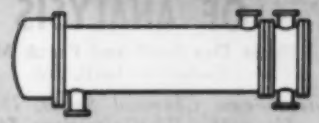

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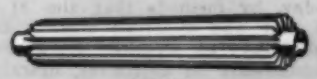

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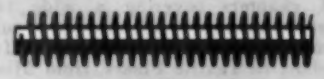

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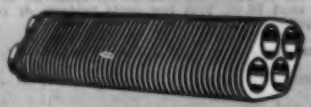

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as president of A.I.C., sounds a timely note of warning against the appalling number of competing and conflicting labor unions with which chemists have become identified in recent years. "We seem to be moving toward the sort of amalgamation of professional workers into a labor front which took place in Germany" and which may have been responsible for the perversion of her technology to Nazi fanaticism. If labor organizations dominated by non-professionals are empowered to control conditions of employment, Egloff concludes that "the technologists will forfeit their traditional freedom and lose their identities as professions."

The main body of this book does not deal with opinions or so-called "institutional copy" intended to promote any single solution or society for handling these problems. Presentation is entirely factual in chapters headed as follows: Scope of the Act; Discretion Vested in the NLRB; Questions Concerning Representation; Desires of Employees; Employer Interference and Domination; Protection for Discrimination; the Appropriate Unit; Selecting a Representative; and the Actual Process of Bargaining.

In the appendix and in the foreword, the association states quite candidly that it will not offer itself as a labor organization to represent technologists in collective bargaining under the Act as now written and administered. Instead it argues that technologists themselves must organize in such a way as to carry full responsibility into the postwar period and "that they must oppose unionization which would in any degree curb the traditional freedom of the profession and thereby obstruct complete utilization by society of the knowledge, training, experience, judgment, initiative and patriotism of technologists."

GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from Superintendent of Documents, Government Printing Office,, Washington 25, D. C. In ordering any publications noted in this list always give the complete title and the issuing office. Remittance should be made by postal money order, coupons, or check. Do not send postage stamps. All publications are in paper covers unless otherwise specified. When no price is indicated, the pamphlet is free and should be ordered from the Bureau responsible for its issue.

Chemical Impregnation of Trees and Poles for Wood Preservation. By B. H. Wilford. Department of Agriculture Circular No. 717. Price 10 cents.

South Carolina Forest Resources and Industries. Department of Agriculture Miscellaneous Publication 552. Price 25 cents.

Iron and Steel Relief Valves for Petroleum, Chemical, and General Industrial Services. Bureau of Standards. Simplified Practice Recommendation R205. Price 5 cents.

Employment Opportunities in Characteristic Industrial Occupations of Women. By Elisabeth D. Benham. Department of Labor.

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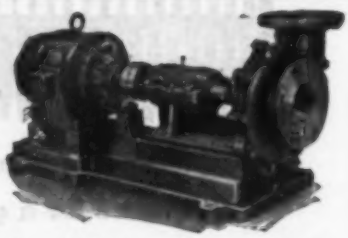

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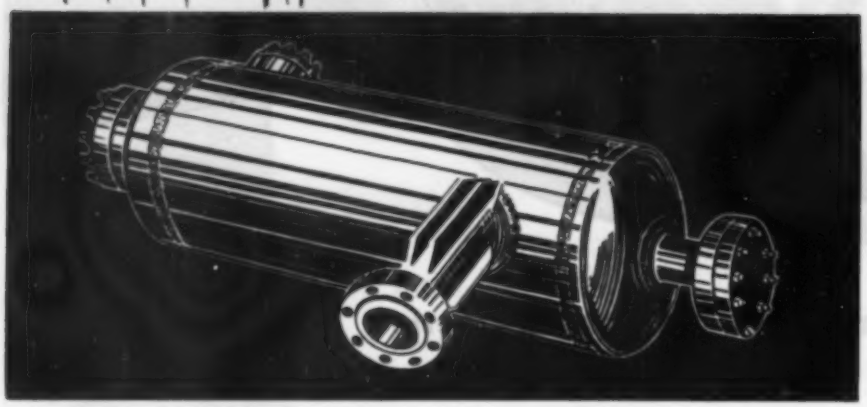

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Women's Bureau Bulletin No. 201. Price 10 cents.

Studies of the Effects of Long Working Hours. By Max D. Kossoris. Bureau of Labor Statistics. Bulletin 791. Part 2 is Bulletin 791-A. Price 10 cents each.

Regulations 116 Relating to the Collection of Income Tax at Source on Wages (With Respect to Wages Paid On or After January 1, 1945). Bureau of Internal Revenue. Price 10 cents.

Sheet (Window) Glass. U. S. Tariff Commission. War Changes in Industry Series Report No. 9. Mimeographed.

Bibliography of Bureau of Mines Investigations on the Production of Liquid Fuels from Oil Shale, Coal, Lignite, and Natural Gas. By Arno C. Fieldner and Paul L. Fisher. Bureau of Mines Information Circular I.C. 7304. Mimeographed.

Natural-Gasoline Plants in the United States, January 1, 1944. By F. S. Lott and E. M. Seeley. Bureau of Mines Information Circular I.C. 7306. Mimeographed.

Industrial-Dust Explosions. By H. R. Brown. Bureau of Mines Information Circular I.C. 7309. Mimeographed.

The Government's Wartime Research and Development, 1940-1944. Report from the Subcommittee on War Mobilization to the Committee on Military Affairs. Subcommittee Report No. 5. Pursuant to S. Res. 107. Part I is a description of the activities of various federal agencies doing war research. Part II of the report will be issued later as a summary.

Surplus Property Board has announced a series of pamphlets containing various sections of the Handbook of Standards for Describing Surplus Property. These pamphlets are not lists of surplus property but are definitions of types and classifications. The sections are grouped into eight pamphlets which deal in turn with the following: (1) Metals and wood products; (2) textile, leather, fiber, chemicals, glass, stone and clay products; (3) paper, rubber, petroleum and coal products; (4) industrial machinery and equipment; (5) plumbing and electrical equipment; (6) transportation (rail, air, water, and highway); (7) office equipment and furniture; (8) food, beverage, and tobacco.

RECENT BOOKS & PAMPHLETS

Classified Directory. Ninth edition. Published by Association of Consulting Chemists and Chemical Engineers, 50 East 41st St., New York 17, N. Y. 108 pages. 1945 edition of list of members and the service they are prepared to render. Cross-indexed.

Putting the Disabled Veteran Back to Work, II. Special Series, Bulletin No. 3 published by Industrial Hygiene Foundation, 4400 Fifth Ave., Pittsburgh 13, Pa. 33 pages. Price 25 cents. A panel discussion at ninth annual meeting of the Foundation.

A Series of Enthalpy-Entropy Charts for Natural Gases. By G. G. Brown. Prediction of Conditions for Hydrate Formation in Natural Gases. By D. L. Katz. Published by Clark Bros. Co., Olean, N. Y. 22 pages. A reprint of two papers presented at the February, 1944, meeting of AIMME.

Technical Association Papers. Edited by R. G. Macdonald and R. T. Bingham. Published by Technical Association of the Pulp and Paper Industry, 122 East 42nd St., New York 17, N. Y. 836 pages. Papers and addresses presented at the February 1944 meeting.

Chemical Products. Published by Domestic Trade Dept., San Francisco Chamber of Commerce, San Francisco, Calif. A mimeographed form, part 8 of this organization's Manufacturers' Directory, which classifies by industry the chemical products and producing firms of the region.

San Francisco Economic Survey. Published by Research Dept., San Francisco Chamber of Commerce, San Francisco, Calif. 32 pages. Statistics on the commerce, industry, agriculture, taxes, climate, finance, markets, mining, population, transportation, etc., of the San Francisco Bay area.

Colorado Springs Region. Published by Colorado Springs Chamber of Commerce, 121 E. Pikes Peak Ave., Colorado Springs, Colo. 20 pages. Discussing broadly and illustrating the industrial facilities, utilities, natural resources, markets and living conditions of the region.

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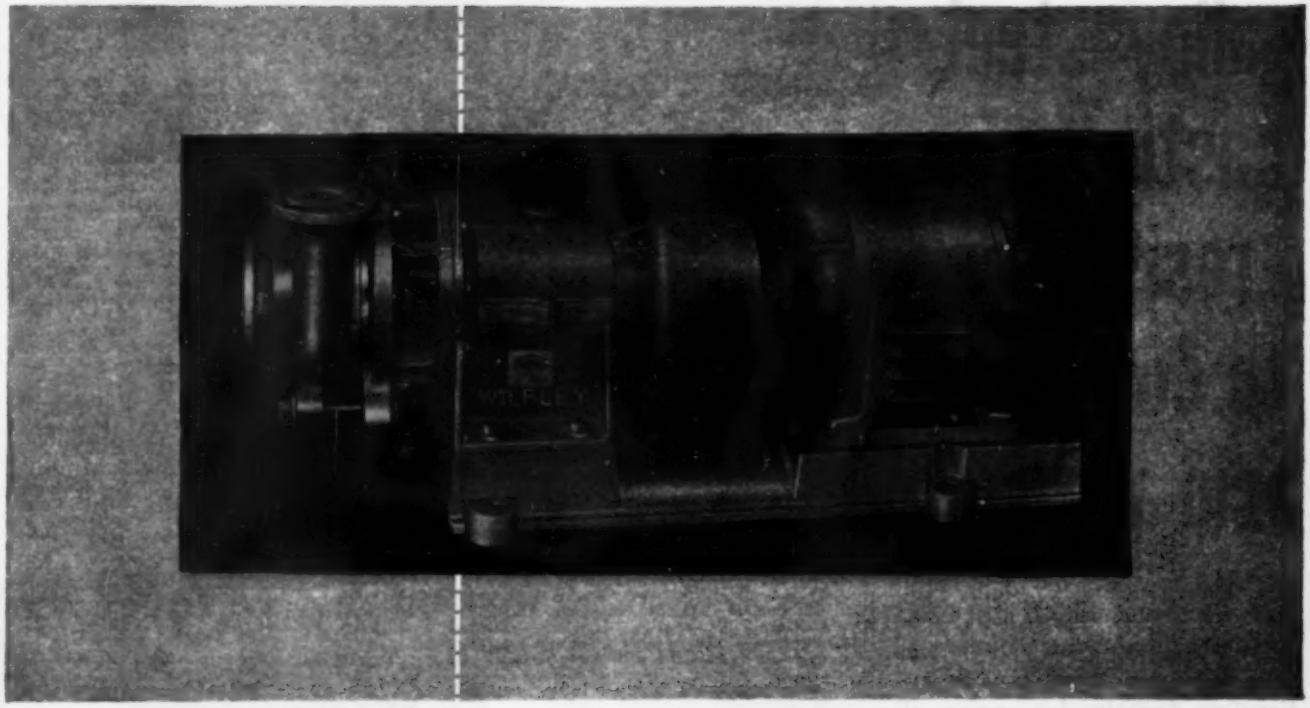

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MANUFACTURERS' LATEST PUBLICATIONS

Publications listed here are available from the manufacturers themselves, without cost unless a price is specifically mentioned. To limit the circulation of their literature to responsible engineers, production men and industrial executives, manufacturers usually specify that requests be made on business letterheads.

Anti-Friction Bearings. Anti-Friction Bearings Manufacturers Association, Inc., 60 East 42nd St., New York, N. Y.—18-page manual giving standard specification data covering types of bearings, a uniform basic part numbering system, standardized workmanship, inspection, tests, and simplified form of tabulated dimensional data. A list of the manufacturers who are members of this association is given.

Blowers. Buffalo Forge Co., Buffalo 5, N. Y.—Bulletin No. 3499. 12-page booklet featuring ventilating blowers and fans. Dimensions and ratings are given. Bulletin No. 3533. 12-page illustrated booklet describing Type B axial flow fans and giving dimensions, ratings and performance curves for this equipment. Bulletin 3553. 12-page booklet featuring Buffalo pressure blowers and centrifugal compressors.

Blueprints. Charles Bruning Co., Inc., 4700 Montrose Ave., Chicago 41, Ill.—28-page booklet describing the equipment used in making black and white positive prints. 6-page folder describing Dulseal, a tissue-thin transparent film for protecting, preserving and repairing tracings, drawings, and prints.

Castings. Sterling Alloys, Inc., Woburn, Mass.—Bulletin 200. 12-page booklet describing the heat and corrosion resisting castings made by this company. Tables covering the physical properties, grades and applications are given.

Chlorinated Paraffins. Diamond Alkali Co., Pittsburgh, Pa.—8-page booklet describing Chlorowax, a new type of chlorinated paraffin, resinous in nature and with flame resistant and moisture resistant properties. Physical and chemical properties together with application data are given.

Coal Crushers. The Jeffrey Mfg. Co., Columbus 16, Ohio—Catalog 784. 40-page catalog covering this company's complete line of crushing equipment useful to the coal using industries. Types, sizes, capacities, space requirements, and the complete range of product sizes are given.

Consistency Control. Paper & Industrial Appliances, Inc., 122 E. 42nd St., New York, N. Y.—8-page illustrated folder describing the principles and features of the Brammer pulp stock consistency control.

Consultants. Foster G. Snell, Inc., 305 Washington St., Brooklyn 1, N. Y.—A revised edition of the brochure entitled "The Consulting Chemist in Your Business" is now available.

Controls. Manning, Maxwell & Moore, Inc., Bridgeport, Conn.—4-page folder describing automatic air control for shallow well water pumps.

Conveyors. Standard Conveyor Co., North St. Paul 9, Minn.—Bulletin No. 60. 8-page booklet giving information on gravity and portable conveyors.

Couplings. Link-Belt Co., 307 No. Michigan Ave., Chicago, Ill.—Book No. 2045. 8-page illustrated booklet giving sizes, dimensions, list prices, and describing this company's roller chain coupling.

Cutters. Zimmerman Packing Co., Cincinnati, Ohio—4-page folder describing the Zim cutter No. 2 used for cutting packings and any other pliable materials.

Dewatering Equipment. Claude B. Schneible Co., 2827 25th St., Detroit 16, Mich.—Bulletin No. 1144. 4-page illustrated folder featuring desettling and dewatering equipment manufactured by this company. Dimensions, capacities and operation information are given.

Drying Ovens. Gehnrich Oven Div., W. S.

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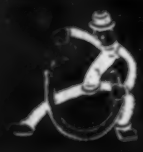

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Rockwell Co., 108 Jewell St., Brooklyn 22, N. Y.—Catalog No. 114. 28-page booklet illustrating the various applications of ovens for baking, drying and curing applications.

Dust Collector. Claude V. Schneible Co., 2827 25th St., Detroit 16, Mich.—Bulletin No. 145. 4-page folder describing the type EC multi-wash dust and fume collector and giving a discussion on the construction, operation, and application of this equipment.

Electronics. Eitel-McCullough, Inc., San Bruno, Calif.—60-page booklet illustrating and discussing broadly the applications of electronics in industry and the types and uses of electronic tubes being put out by their concern. Bulletin A612.

Electronic Equipment. North American Philips Co., Inc., 100 E. 42nd St., New York 17, N. Y.—8-page condensed catalog featuring many of the products made by this company.

Electronic Heating. Scientific Electric, 107-119 Monroe St., Garfield, N. J.—16-page illustrated booklet describing the fields of application and methods of electronic heating.

Feedwater Treatment. Cochrane Corp., 17th St. and Allegheny Ave., Philadelphia 32, Pa.—Reprint No. 39. 4-page folder discussing the removal of ammonia from boiler feedwater. This includes the use of chlorine, mechanical means, and ion exchangers.

Filters. Hercules Filter Corp., 9 Washington Ave., Paterson, N. J.—18-page booklet describing and illustrating the various types of filter presses manufactured by this company. Features of design together with application installation and operating data are shown.

Fluid Catalytic Cracking. M. W. Kellogg Co., 225 Broadway, New York 7, N. Y.—Special edition of the Kellogg ram illustrating and describing the fluid catalytic cracking process, together with a list of the fluid catalytic cracking plants in this country.

Heat Exchangers. American District Steam Co., North Tonawanda, N. Y.—12-page loose-leaf illustrated booklet on heat exchange equipment. Dimensions, capacity tables, and list prices are given. Bulletin No. 33-76B.

Hydraulic Equipment. John S. Barnes Corp., 301 So. Water St., Rockford, Ill.—28-page illustrated booklet describing hydraulic circuits for use with industrial equipment.

Instruments. Bailey Meter Co., 1050 Ivanhoe Road, Cleveland 10, Ohio—Bulletin 230-A. 12-page illustrated booklet giving the outstanding features of the Pyrotron electronic resistance thermometers made by this company.

Instruments. Gotham Instrument Co., 149 Wooster St., New York 12, N. Y.—8-page illustrated leaflet describing indicating and recording thermometers.

Instruments. Taber Instrument Corp., North Tonawanda, N. Y.—8-page illustrated folder describing the Taber abraser testing set for use in determining the wear or abrasion resistance of practically every material subject to surface abrasion.

Industrial Colors. U. S. Gutta Percha Paint Co., Providence, R. I.—16-page brochure discussing color selection for the promotion of safety and efficiency in industrial plants.

Materials Handling Equipment. Automatic Transportation Co., 101 W. 87th St., Chicago 20, Ill.—Collection of bound bulletins describing the use of electric industrial trucks. Bulletins Nos. 1 to 10.

Metal Hose. Packless Metal Products Corp., New Rochelle, N. Y.—Illustrated manual showing the complete line of flexible metal hose and accessories made by this company.

Mixers. Reynolds Electric Co., 2650 West Congress St., Chicago 12, Ill.—Bulletin 631. 2-page leaflet describing bench and floor type multi-speed mixers.

Molasses By-Products. General American Transportation Corp., 420 Lexington Ave., New York 17, N. Y.—12-page booklet discussing the by-products from molasses fermentation.

Oil Refining. The M. W. Kellogg Co., 225 Broadway, New York, N. Y.—Booklet entitled "Oil Refining," a condensed but comprehensive review of the major refining processes now being used.

Open Heaters. Cochrane Corp., 17th St. and Allegheny Ave., Philadelphia 32, Pa.—Bulletin 4091. Illustrated booklet describing direct contact open heaters used in heating water for boiler feed or process requirements. Various

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applications of the jet heater, V-notch metering heater, and tray heater are given.

Power Plants. Westinghouse Electric & Mfg. Co., Pittsburgh 30, Pa.—Bulletin B-3153. 40-page steam power plant planning guide gives performance data on various kinds of steam plant equipment.

Pumps. Claude B. Schneible Co., 2827 25th St., Detroit 15, Mich.—4-page leaflet featuring both vertical and horizontal type pumps designed specifically for handling sludge with minimum clogging and wear. Bulletin No. 1244.

Pumps. Marlow Pumps, Ridgewood, N. J.—20-page booklet describing self-priming centrifugal pumps. Principles of operation, performance data, together with installation and application information are given.

Radiant Heating. A. M. Byers Co., Pittsburgh, Pa.—52-page booklet featuring radiant heating coils located in floors and ceilings. Data are given for figuring heat losses and piping requirements, and designing the coils. Typical installations are illustrated covering a wide range of structures.

Redwood Bark Insulation. Pacific Lumber Co., 100 Bush St. San Francisco, Calif.—8-page booklet giving technical data on insulating and other properties of shredded redwood bark. Also 14-page booklet entitled "Cold Storage Manual" which gives technical and engineering data on the use of this material as an insulation in cold storage plants.

Remote Control Valves. Grove Regulator Co., 1190-67th St., Oakland 8, Calif.—20-page booklet that illustrates and discusses the Flexflo expansible tube remote control valves and their applications in various process industries. Contains capacity and dimensions data. Bulletin No. 800.

Resins. Hercules Powder Co., Wilmington, Del.—Technical bulletin describing and evaluating Pentalyn resins and their applications in the varnish and paint industry. Physical and chemical properties of the four Pentalyns A, G, M and X, is provided.

Rotary Blowers. Pottstown Blower Co., 431 Fayette Ave., Mamaroneck, N. Y.—Bulletin T-100. 16-page illustrated booklet describing the principle of operation and the design and construction features of rotary positive displacement type blowers and exhausters. Specifications, capacity tables and technical application data are given.

Safety Mask. Martindale Electric Co., Box 617, Edgewater Branch, Cleveland 7, Ohio—4-page folder describing face mask for protection of workers against industrial dust. The features and usefulness of this mask together with its limitations are discussed.

Screens. J. H. Day Co., Cincinnati 22, Ohio—16-page illustrated catalog featuring the Ro-Ball stabilized gyrating screen, and other materials handling equipment. A list of materials handled by this equipment is given. Bulletin No. 377.

Spray Dryers. Swenson Evaporator Co., Harvey, Ill.—Catalog D-100. 8-page illustrated bulletin describing the application, operation and the main features of the complete line of spray drying equipment manufactured by this company.

Steam Jet Ejectors. Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.—8-page illustrated folder gives operating characteristics, principles, and features, as well as construction details and schematic diagrams of various types of installations. Form 9013.

Vinyl Resins. Resistoflex Corp., Belleville, N. J.—16-page illustrated catalog of industrial products made from Compar, a special solvent-proof vinyl resin.

Water Treatment. Cochrane Corp., 17th St. and Allegheny Ave., Philadelphia 32, Pa.—3-page article discussing feed water treatment for high-pressure boilers. Reprint No. 37. Booklet containing information on green sand Zeolite softeners. Publication 2860A.

Welding. Eutectic Welding Alloys Co., 40 Worth St., New York 13, N. Y.—6-page folder describing a low temperature welding process for repair and maintenance. Useful information is given on the selection of proper welding rods for various materials.

X-Ray Diffraction. North American Phillips Co., Inc., 100 East 42nd St., New York 17, N. Y.—12-page booklet showing the outstanding features of Norelco X-ray diffraction equipment. Included is a table giving the use of this equipment for various types of applications. Also, 4-page article outlining methods of application of X-ray diffraction equipment.

CHEMICAL ECONOMICS

H. M. BATTERS, Market Editor

CHEMICAL OUTPUTS MAINTAIN RISING TREND WITH OUTLOOK CLOUDED BY WAR DEVELOPMENTS

INDUSTRIAL production, while somewhat lower than it was a year ago, has reversed the downward trend which set in last July and continued over the remainder of last year. The unadjusted index of the Federal Reserve Board for February places all production at 231 or a full point higher than the January figure. The Board further reports a continuance of the rising trend over the first half of March. The Board credits production of industrial chemicals as moving in close harmony with total production but indicates that the output of chemicals—which classification includes some allied products—has risen more rapidly than that for industry as a whole, the index number for February having moved up to 319 for a four point gain over February.

Revised data for activities in the principal consuming industries caused the *Chem. & Met.* index for consumption to move up to 188.37 for January which is an all-time high for the index. Unusually high outputs in the superphosphate, petroleum refining, paint and varnish, and rayon industries had much to do with the upward swing. Several unfavorable factors were encountered in February which, combined with the smaller number of working days, resulted in a sharp drop in the index which stood at 176.69 for the month. Last year the index numbers for January and February were 182.74 and 181.74 respectively.

When complete figures for March become available it is expected they will reveal a very satisfactory showing for the month. This applies both to total industrial production and production and consumption of chemicals. Weekly reports on operations at steel mills tell of near capacity activities, fertilizer demands were increased, and oil refineries made a new monthly record.

Total production of chemicals is influenced by the large amounts which are going into the manufacture of ammunition. While there has been no let up in this direction, it is improbable that further speeding up of chemical outputs will be necessary as the favorable progress of the war has brought the announcement that the War Department has decided to discontinue construction of certain artillery and mortar ammunition plants which could not be completed and put into capacity production until late in the year. Plants now in operation, however, are expected to maintain present production schedules and new facilities which will be ready to function in the near future also will be operated. However, production schedules and raw material requirements as presently visualized may be subject to drastic readjustments dictated by developments on the war fronts.

While production of civilian goods has gone ahead very well considering the restrictions of limiting orders, allocations, and the necessity for wide use of substitute materials, handicaps in some fields continue to multiply. Paint makers are forced to cut down on consumption of pigments, chemical colors, and oils. Late last month an amended order reduced the amount of linseed oil available for paint to 40 percent of its average use in 1940 and 1941. Under these conditions, it is certain that after filling military orders, paint makers will have a smaller surplus for general distribution.

Soap makers are not only adversely affected by the orders limiting the amount of vegetable oils available for soap but also are restricted in their use of rosin and are faced with the announcement that all oils and fats will be in greatly smaller supply than they were last year while requirements for soap will be maintained at last year's level.

Manufacturers of dyes are finding it difficult to fill requirements for their products owing to the shortage of some of the important raw materials. The amount of phthalic anhydride allotted for dyes does not permit of its use for civilian orders and has been running about 4 percent below the actual military needs. Of the total annual production of phthalic anhydride of about 140,000,000 lb., 10 percent is needed by the dye industry which was granted 980,000 lb. for the month of April, all of this marked for military orders. For civilian use, other intermediates must be found and this entails adjustments in processes with consequent delay in turning out the finished products.

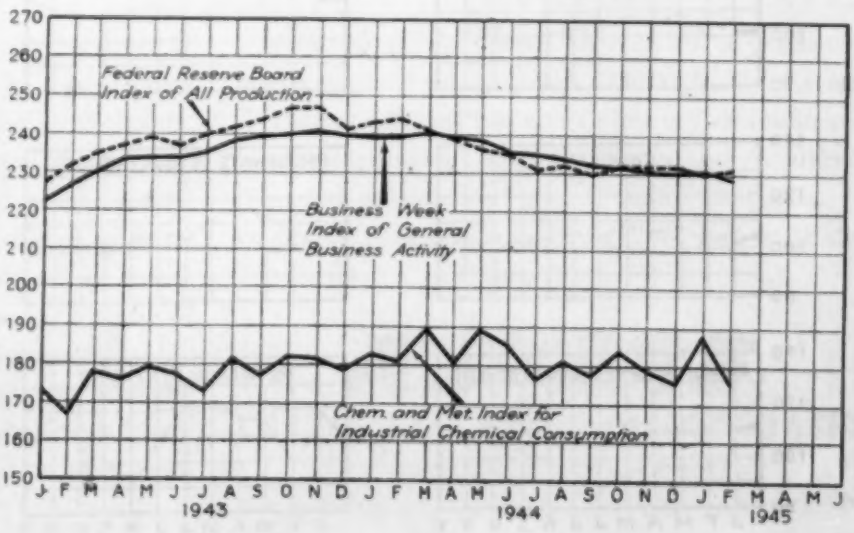
The short supply of caustic potash has brought up the question of placing it under allocation control. Producers have not looked on this with favor as they believe that new production soon will bring the market into balance and in the meantime they are working in cooperation with government agencies to maintain deliveries for essential requirements. Stearic acid has been in active demand with enlarged consumption threatening to make it necessary to establish directives over shipments.

Production of chlorine for the second quarter is estimated at 345,800 tons which has been allotted against requests which totalled 380,870 tons. Allocations for the quarter are relatively lower than in the past due to an increase in demand for chlorine for military purposes. Allocations for chemicals are 256,449 tons to which may be added 11,432 tons for sodium and calcium hypochlorites. Hence, nearly 77½ percent of chlorine is going into chemicals with the next largest consumer, pulp and paper taking less than 12½ percent, and water and sewage less than 3 percent.

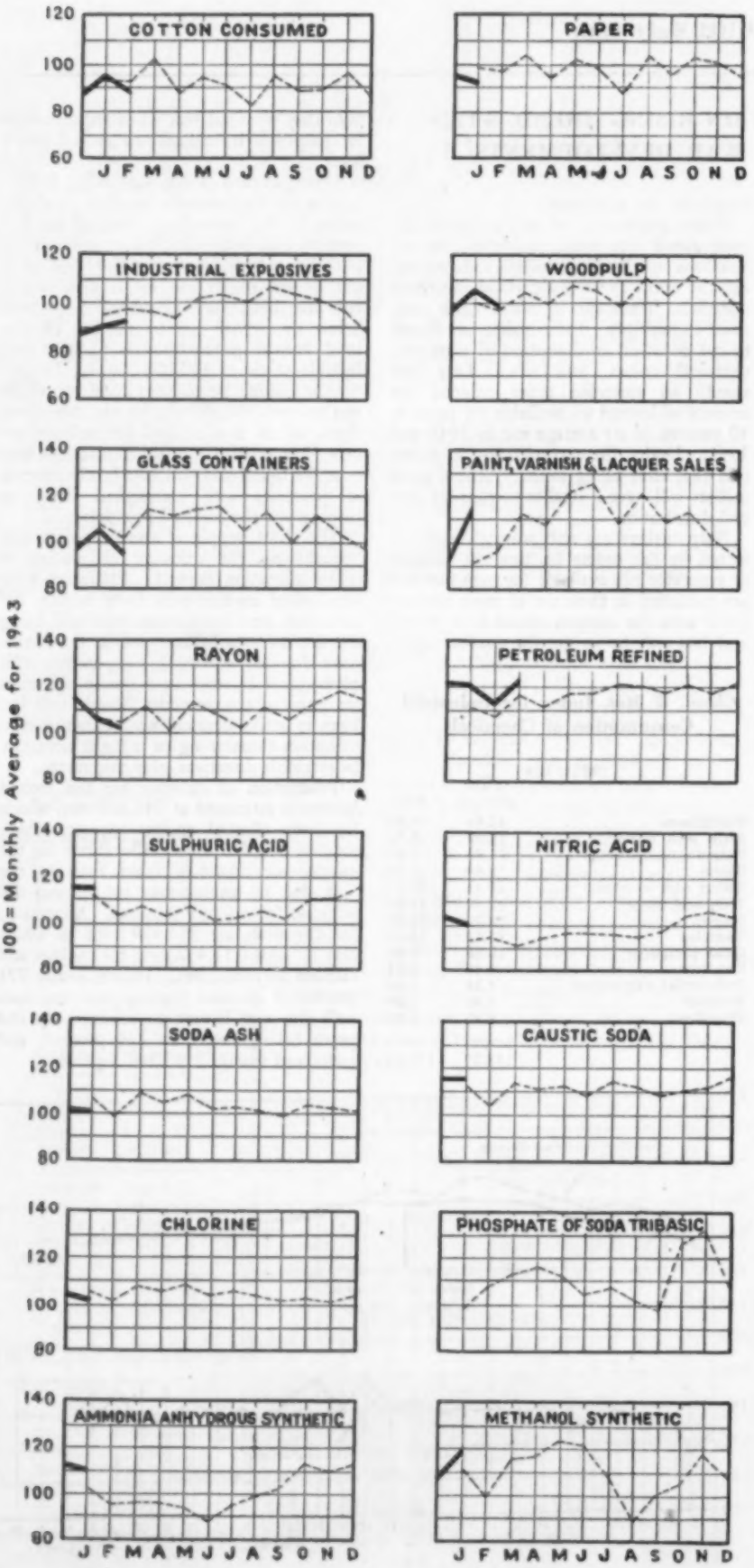
***Chem. & Met.* Index for Industrial Consumption of Chemicals**

1935=100

	Jan. revised	Feb.
Fertilizers	43.03	40.10
Pulp and paper	19.29	18.75
Petroleum refining	18.63	17.43
Glass	19.80	18.10
Paint and varnish	17.44	16.72
Iron and steel	13.07	11.85
Rayon	18.45	16.30
Textiles	11.13	10.35
Coal products	10.05	9.90
Leather	4.45	4.35
Industrial explosives	4.93	5.04
Rubber	3.00	3.00
Plastics	4.95	4.80
	188.37	176.69



PRODUCTION AND CONSUMPTION TRENDS



CONTROLS OVER the distribution of raw materials do not necessarily mean that consuming industries are affected by cuts in their allotments to the full extent of the cuts themselves. In most cases the shortage in materials can be overcome in part by the use of substitute materials. In the case of paper manufacture, however, no substitute can be found for pulp and when an order regulating the flow of pulp becomes effective, it likewise foretells the status of paper production.

The position of pulp and paper for the second quarter of this year, therefore, may be inferred from the fact that for that period, 2,599,700 tons of wood pulp have been allocated for the manufacture of a minimum of 4,371,237 tons of paper and paperboard. Wood pulp allocated for the first quarter was 2,681,650 tons for the manufacture of a minimum of 4,401,963 tons of paper and paperboard.

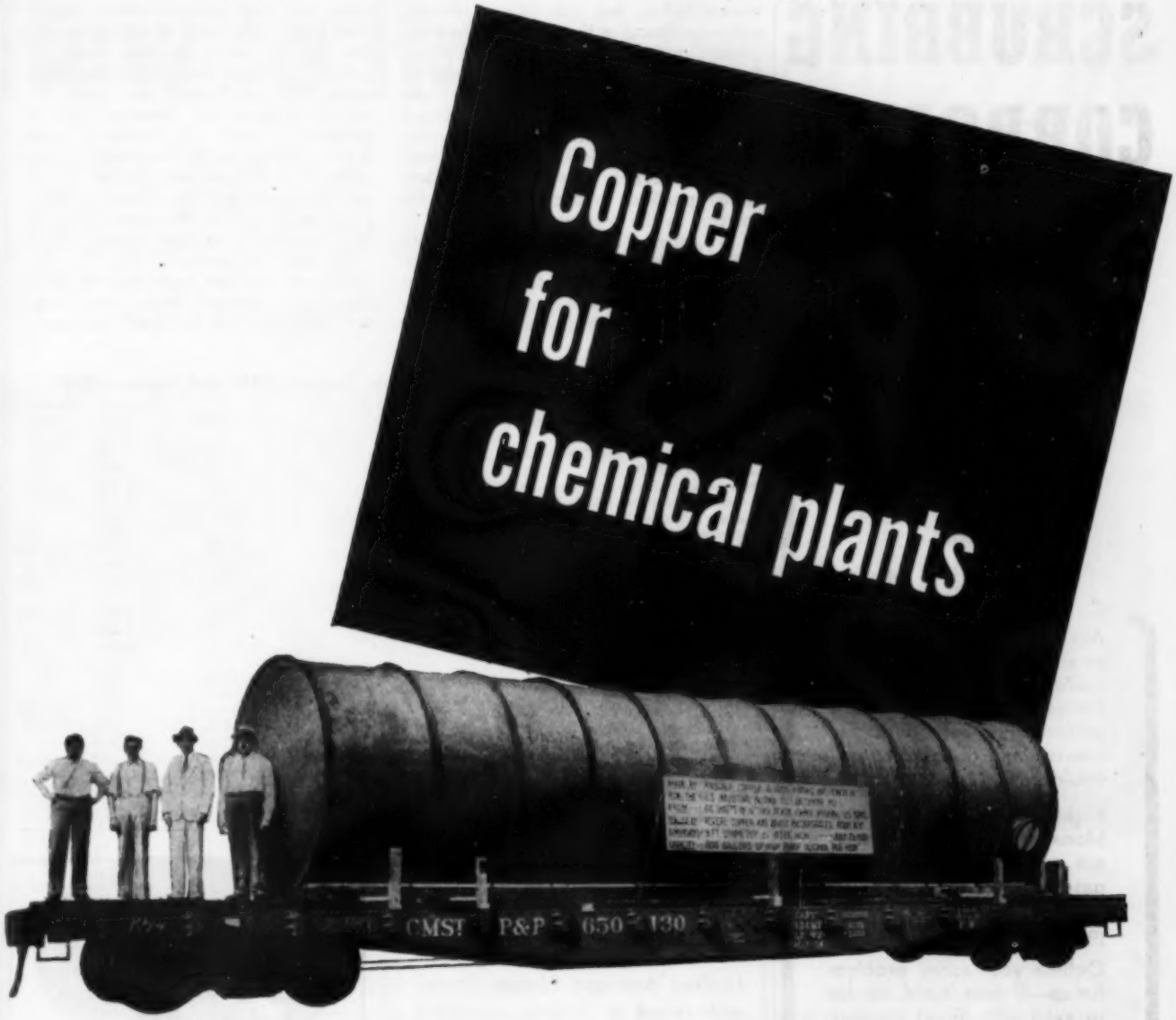
A total of 243,010 tons of pulp also was allocated for the manufacture of other products including rayon, explosives, cellophane and plastics, and for export. Exports of pulp in the first quarter amounted to 60,863 tons.

The trend in synthetic rubber production is upward with the figure of 763,255 long tons—the total produced last year—scheduled to reach about 1,000,000 long tons this year. A 30 percent increase over the March rate is expected to be attained by the middle of the year. Because the carbon black supply is inadequate, use of other materials has been substituted in the manufacture of some types of rubber goods. As the addition of reclaimed rubber serves to cut down requirements for carbon black, reclaimers have been asked to increase their rate of operations so that an upward trend for rubber reclaiming has started and should continue until such time as carbon black is available for all needs.

A good part of rayon production is now given over to turning out high tenacity yarn and while a high rate of operations has been maintained so far this year, producers have run into rather serious manpower problems and have asserted that proposed increases in yarn outputs will not be possible without help in bringing more workers to the plants. Not only will the rising trend for yarn production be reversed but a drop of about 12 percent in high tenacity yarn production is predicted for the second quarter unless the labor situation is relieved.

Reviewing first quarter activities, it is found that of the most important consumers of chemicals, oil refiners, synthetic rubber manufacturers, rayon mills, fertilizer plants are moving ahead of their records for last year. Soap makers are plagued by additions to restrictive orders and find it increasingly difficult to maintain full production because of the raw material supply.

Among the chemicals, considerable attention has been given recently to the movement of mercury. The rising price trend for a time was the most important



Tank made by Ansonia Copper & Iron Works, Cincinnati, Ohio.

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To make the tank illustrated above, 66 sheets of 1/8" Revere copper were used. Weight, 25 tons. Dimensions, 9′ in diameter by 40′. For use in an alcohol plant.

Revere has been rolling copper for 144 years, and being the oldest metal-working firm in the country, we know how to do it right. It is used in many essential chemical plant applications because of its chemical properties, its resistance to corrosion, its ease of fabrication, and its high thermal conductivity.

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Fig. 645

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Outline your spray problem for us—If your liquid can be sprayed with direct pressure at all—Monarch can furnish the nozzles.

NOZZLES FOR:

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Write for Catalogs 6-A and 6-C

MONARCH MFG. WKS. INC.
2730 E. WESTMORELAND ST.
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market feature but with foreign offerings either increasing or threatening to be more readily available, the price factor has been dwarfed by the steady movement of the material to consumers. War uses naturally are responsible for the enlarged consumption of mercury and mercury products with particular emphasis placed on the relatively new mercury battery which promises to offer a wide use for mercury in the postwar period.

In general, the trend for chemicals and for raw materials for chemical manufacture is to expand the column for scarce products. Natural resins have been imported in a limited way and domestic resins and other products which might be substituted, fall short of requirements so the imported resins are now under allocation. Chemical lime is now among the scarce items and while not under allocation, shippers are observing the importance of end uses before accepting orders. Hydroquinone is wanted in larger amounts in the synthetic rubber industry and for smoke dyes for chemical warfare. Plans are under way to obtain manganese ore from Russia so that more hydroquinone may be produced. For the third quarter of this year a shortage of carbon dioxide is expected and some control over deliveries may be found necessary.

U. S. Production of Certain Chemicals, January 1945 and January 1944

Chemical and Basis	Units	January 1945	January 1944
Aluminum chloride			
Anhydrous & crystal (100% $AlCl_3$)	M lb.	5,140	.....
Solution (32° Be)	M lb.	1,034	.....
Ammonia, synthetic anhydrous (100% NH_3)[1]	Tons	49,863	46,487
Ammonium chloride (100% NH_4Cl)	M lb.	5,075	.....
Barium sulphate (100% $BaSO_4$)	M lb.	5,042	.....
Bleaching powder (35-37% avail. Cl_2)	M lb.	1,950	5,595
Calcium acetate (80% $Ca(C_2H_3O_2)_2$)	M lb.	785	1,190
Calcium arsenate (100% $Ca_3(AsO_4)_2$)	M lb.	1,766	2,541
Calcium hypochlorite (70% avail. Cl_2)	M lb.	1,317	1,098
Calcium phosphate			
Monobasic (100% $CaH_4(PO_4)_2$)	M lb.	4,716	5,532
Dibasic (100% $CaHPO_4$)	M lb.	3,519	....
Carbon, activated	M lb.	5,069	.....
Carbon black (channel)			
Rubber grade	M lb.	35,667	.....
Other grades	M lb.	2,462	.....
Chlorine	Tons	103,953	106,333
Chrome green (C.P.)	M lb.	646	563
Chrome yellow & orange (C.P.)	M lb.	3,356	.....
Hydrochloric acid (100% HCl)	Tons	35,008	29,048
Hydrogen peroxide (100 volumes)	M lb.	2,636	.....
Lamp black	M lb.	1,121	.....

(*Continued on page 242*)

TO MANUFACTURERS SEEKING AN EXPORT MARKET

Leading American Foreign Trader with record of 50 years successful operations in foreign markets is seeking additional lines of important American producers of industrial chemicals and pharmaceutical products for distribution throughout the Orient and Latin America.

Head sales office for Latin America is established in Buenos Aires. Prewar connections in the Orient will be immediately re-established when conditions permit. Sales agencies under guidance of experts experienced in each market.

If you are seeking clean aggressive representation write us details of your products for both immediate and postwar selling. If interested we will have a representative call on you for further discussions.

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FOR THE CHEMICAL PROCESS INDUSTRIES

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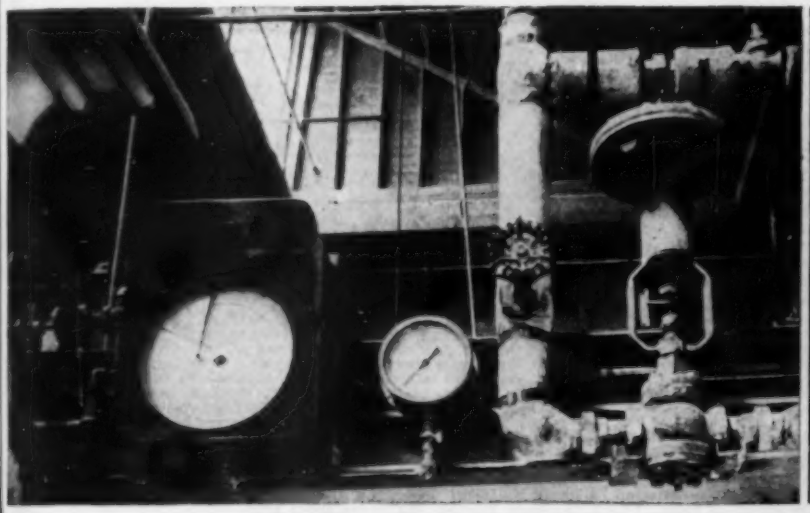


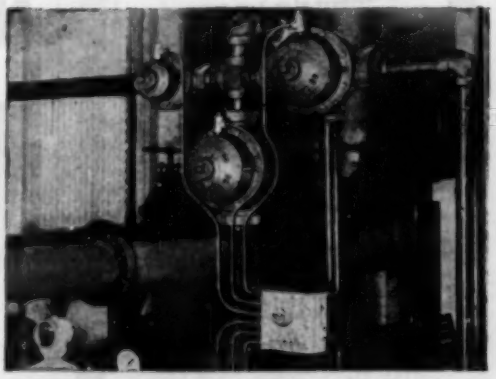
★ One of the McAlear No. 110 Diaphragm Motor Valves controlling saturated steam pressure to wire rubber-processing machines in plant of leading manufacturer of wire and cable.

★ McAlear No. 455 Pump Governor regulating speed of steam vacuum pump on condensate return lines of large Government housing project.

DEPENDABLE, long-life, high precision, low maintenance control instruments for more than 500 specific applications in power and process industries have been developed by McAlear.

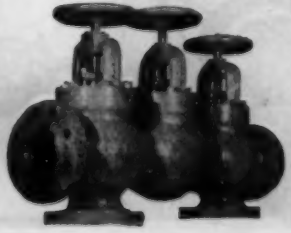
For *every* application that involves exacting control or regulation of temperature, flow, level or pressure of steam, water, air, gas, chemicals or oil—*McAlear either has the control you need*—or will develop it for you.

If *you* have a control problem call on McAlear engineers. Draw on their fund of experience . . . on their readiness and willingness to help you. For informative bulletins or catalog, write McAlear Manufacturing Company, 1939 S. Western Avenue, Chicago 8. *Affiliated with Hanlon-Waters, Tulsa, Oklahoma; Climax Engineering Company, Clinton, Iowa.*



★ McAlear No. 1455 Pilot Operated Diaphragm Valves controlling flow of hard-to-handle liquid in processing operation.

H-W TYPE 1800 Compact By-Pass Manifold simplifies piping designs, eliminates many flanged or screwed connections, saves space, reduces leakage hazards, without increasing installation costs. Sizes ½ to 4 inches. Bronze, cast iron, steel, screwed, flanged, silver braze and steel socket weld ends. Write for bulletin No. 117.



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No. 3—Ideal for general oil type lubrication. Ring oiled bearings, wick feeds, sight feeds and bottle oilers.

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BALL BEARING—This is the LUBRIPLATE lubricant that has achieved wide acclaim for use in the general run of ball and roller bearings operating at speeds to 5000 RPM and temperatures up to 300 degrees F.

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U. S. Chemical Production (cont. from p. 240)

Chemical and Basis	Units	January 1945	January 1944
Lead oxide			
Red (C.P.)	M lb.	7,911	9,218
Yellow (C.P.)	M lb.	29,647	.....
Methanol			
Natural (80% CH_3OH)	M gal.	317	375
Synthetic (100% CH_3OH)	M gal.	6,455	6,007
Molybdate chrome orange (C.P.)	M lb.	137	.....
Nitric acid (100% HNO_3)	Tons	40,749	37,621
Phosphoric acid (50% H_3PO_4)	Tons	51,218	65,003
Potassium bichromate & chromate (100%)	M lb.	596	763
Potassium hydroxide (100% KOH)	Tons	4,124	3,558
Soda ash (commercial sodium carbonate)			
Ammonia soda process (98-100% Na_2CO_3)			
Total wet & dry[2]	Tons	365,718	393,474
Finished light[3]	Tons	186,516	220,945
Finished dense	Tons	124,948	121,236
Natural[4]	Tons	.....	13,479
Sodium bicarbonate (100% $NaHCO_3$)	Tons	12,614	13,498
Sodium bichromate & chromate (100%)	Tons	6,582	7,029
Sodium bisulphite (100% $NaHSO_3$)	M lb.	2,947	.....
Sodium hydrosulphide (100% NaSH)	M lb.	1,710	.....
Sodium hydrosulphite (100% $Na_2S_2O_4$)	M lb.	3,121	.....
Sodium hydroxide (100% NaOH)[5]			
Electrolytic process			
Liquid	Tons	101,993	100,619
Solid	Tons	19,461	.....
Lime-soda process			
Liquid	Tons	63,360	57,396
Solid	Tons	19,860	.....
Sodium silicate (anhydrous)	Tons	38,397	.....
Sulphuric acid (100% H_2SO_4)[6]			
Chamber process	Tons	296,416	287,266
Net contact process[7]	Tons	477,800	455,042
White lead			
Basic lead carbonate	Tons	5,105	.....
Basic lead sulphate	Tons	1,004	.....
Zinc yellow (zinc chromate) (C.P.)	Tons	1,492	.....

Data for this tabulation have been taken from the "Facts for Industry" series issued by the Bureau of the Census and the WPB Chemicals Bureau. Production figures represent primary production and do not include purchase or transferred material. Quantities produced by government-owned arsenals, ordnance works, and certain plants operated for the government by private industry are not included. Chemicals manufactured by TVA, however, are included. All tons are 2,000 lb. Where no figures are given, data are either confidential or not yet available. [1] Includes a small amount of aqua ammonia. [2] Total wet and dry production including quantities diverted for manufacture of sodium bicarbonate and caustic soda and quantities processed to finished light and finished dense soda ash. [3] Not including quantities converted to finished dense soda ash. [4] Data collected in cooperation with the Bureau of Mines. [5] Figures represent total production of liquid material, including quantities evaporated to solid caustic and reported as such. [6] Include oleum grades. Excludes spent acid.

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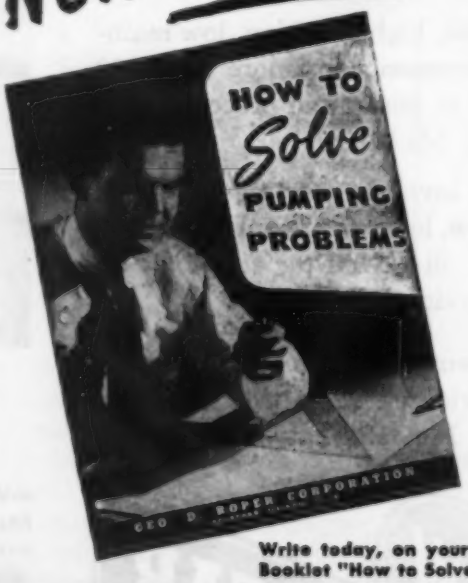

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Of course, one of the outstanding qualities of this product, which makes a strong appeal to building owners, is its amazing durability. Corrugated Transite lasts indefinitely . . . requires no painting . . . no preservative treatment . . . no upkeep whatever. It's absolutely unaffected by the weather.

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1. ***It's durable,*** because it's made of asbestos and cement, two almost indestructible materials, compressed and corrugated under terrific pressure for extra strength.

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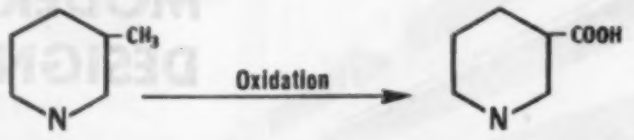
The most direct process for producing Nicotinic Acid, the pellagra-preventive factor of the Vitamin B Complex, is by the oxidation of *Reilly* 3-Picoline.



BETA PICOLINE — NICOTINIC ACID

Nicotinic Acid can also be made from *Reilly* QUINOLINE and from *Reilly* PYRIDINE.

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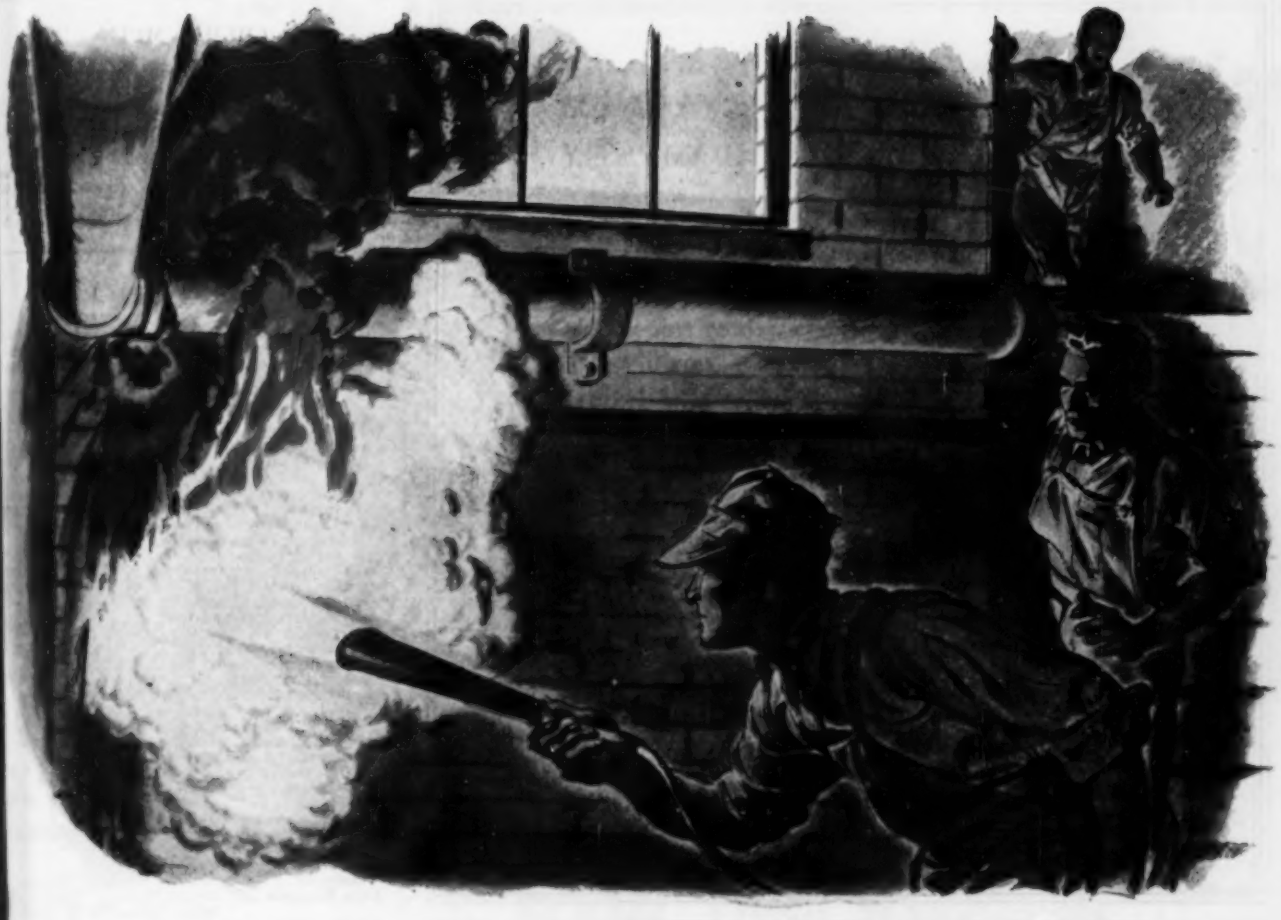
★ 17 PLANTS *To Serve the Nation*

U. S. Production, Consumption and Stocks of Synthetic Organic Chemicals January 1945 and January 1944

Item	January 1945	January 1944
Acetanilide		
Production	.....	439,143
Consumption	84,433	270,368
Stocks	398,903	787,278
Acetic acid (synthetic)[1]		
Production	26,314,634	25,234,706
Consumption	20,404,074	19,555,315
Stocks	10,899,650	9,436,836
Acetic acid (natural)[2]		
Production	3,211,541	3,512,334
Stocks	1,520,274	1,529,206
Acetylsalicylic acid		
Production	886,302	753,587
Stocks	1,114,337	749,336
n-Butyl acetate		
Production	6,270,675	5,009,444
Consumption	170,445	149,273
Stocks	3,578,806	2,298,399
Creosote oil, tar distillers[3]		
Production	9,531,634	11,305,961
Consumption	760,390	810,986
Stocks	8,863,095	19,155,075
Creosote oil, byproduct[4,5]		
Production	3,041,378	2,965,392
Consumption	21,602	160,198
Stocks	832,225	1,380,822
Cresols, meta-para[5]		
Production	666,188	563,339
Consumption	203,174	.....
Stocks	.....	151,686
Cresols, ortho-meta-para[5]		
Production	735,034	584,661
Stocks	.....	304,561
Cresylic acid, crude		
Production	2,336,198	1,965,234
Stocks	1,114,677	1,306,774
Cresylic acid, refined[5]		
Production	3,675,638	2,723,855
Stocks	1,471,662	1,982,414
Diethyl ether (all grades)		
Production	7,621,243	4,967,060
Stocks	3,039,799	2,463,017
Ethyl acetate (85 percent)		
Production	9,027,451	9,914,309
Consumption	1,824,489	1,513,661
Stocks	6,873,049	5,105,921
Lactic acid (edible)		
Production	411,445	437,941
Stocks	238,442	345,584
Lactic acid (technical)		
Production	417,050	246,126
Consumption	17,232	10,009
Stocks	221,530	173,336
Methyl chloride (all grades)		
Production	2,583,022	1,291,121
Stocks	619,609	1,078,377
Naphthalene (coke-oven)[5,7]		
Production	7,358,866	9,368,271
Stocks	3,085,135	2,447,776
Naphthalene (tar distillers)[3]		
Production[8]	15,367,355	15,072,813
Stocks	7,479,726	9,827,554
Naphthalene (refined)[9]		
Production	5,380,973	7,288,315
Consumption	4,217,039	4,061,657
Stocks	2,098,577	3,042,856
Oxalic acid (technical)		
Production	1,663,270	1,490,236
Stocks	400,252	681,722
Phenobarital and sodium salts		
Production	20,300	22,494
Stocks	36,225	68,451
Phthalic anhydride		
Production	10,319,502	9,205,342
Consumption	3,921,283	2,570,729
Stocks	1,512,079	1,564,233
Riboflavin (for human use)		
Production	.....	9,750
Consumption	1,568	.....
Stocks	32,532	24,150
Sulfa drugs (total)[10]		
Production	377,480	683,705
Consumption	.....	198,104
Stocks	780,850	1,202,334

Statistics collected and compiled by the U. S. Tariff Commission except where noted. In pounds except that creosote oil is expressed in gallons. Where no figures are given, data are confidential. [1] Excludes recovered acetic acid. [2] Acetic acid produced by direct process from wood and from calcium acetate. Compiled by Bureau of Census. [3] Product of distillers who use purchased coal tar only. [4] Product of byproduct coke-oven operators only. [5] Statistics collected and compiled by Coal Economics Division, U. S. Bureau of Mines. [6] Statistics reported by byproduct coke-oven operators combined with those reported by tar distillers to prevent disclosure of operations of individual companies. [7] Statistics combine three grades: solidifying at less than 74; 74 to less than 76; and 76 to less than 79 deg. C. [8] Production for sale only in case of less than 74 grade. Production both for consumption within producing plant and for sale in case of other two grades. [9] 79 deg. C. and over. [10] Includes data for acetylsulfathiazole both as drug and as intermediate, resulting in appreciable unavoidable duplication.



KILL TOUGH FIRES BEFORE THEY GROW—WITH KIDDE EQUIPMENT

WHEN tough fires spring up—the fast-moving ones that break out in flammable liquids (Class B); the hard-to-get-at kind that start in electrical equipment (Class C)—the Kidde portable or hose reel system acts fast to knock them down—and *out*!

Ordinary water-type extinguishers can't control these tough fires. But the Kidde portable shoots out a cloud of carbon dioxide gas, forming a heavy blanket that smothers the flames. Then the dry, inert, non-toxic gas merely evaporates...leaving valuable liquids *uncontaminated*, electrical equipment *undamaged*. This Kidde method is recognized as one of the speediest, cleanest and safest fire-fighters in use today.

It's smart to check on tough fire areas in your own plant. Does the accompanying list of typical hazards suggest places that still need safeguarding? If it does, call in a Kidde representative—you'll find him wise when it comes to fire protection. Drop us a line.

Kidde Kills Tough Fires

- PROCESS ROOMS
- MIXING TANKS
- AGITATORS
- PUMP ROOMS
- STORAGE AREAS
- DRUM-FILLING ROOMS
- MOTORS
- TRANSFORMERS
- ELECTRICAL CONTROL PANELS

K Kidde

The word "Kidde" and the Kidde seal are trade-marks of Walter Kidde & Company, Inc.

Walter Kidde & Company, Inc. • 140 Cedar Street • New York 6, N. Y.

OLDBURY
ELECTRO-CHEMICAL COMPANY

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PHOSPHORUS TRICHLORIDE

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PRODUCTION problems connected with Phosphorus Trichloride parallel very closely those of Phosphorus Oxychloride. Here again experience and continuous technical improvements enable us to produce a material remarkably free from impurities.

Shipping containers are returnable drums and tank cars.

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Plant and Main Office: NIAGARA FALLS, NEW YORK

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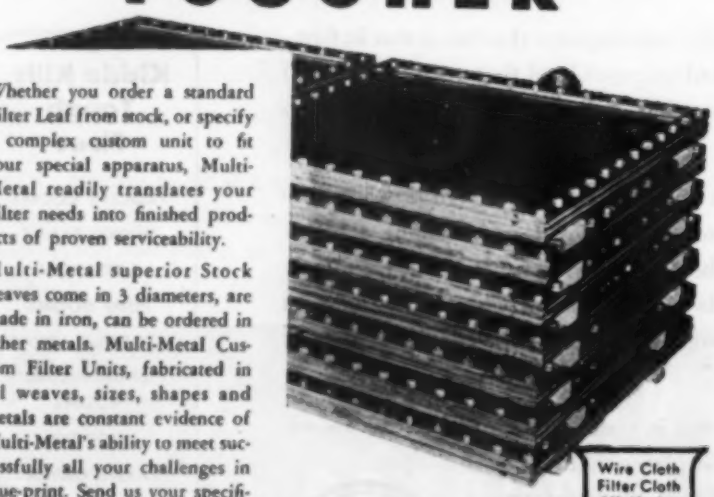
MULTI-METAL

likes its Filter Unit problems

TOUGHER



Whether you order a standard Filter Leaf from stock, or specify a complex custom unit to fit your special apparatus, Multi-Metal readily translates your Filter needs into finished products of proven serviceability.

Multi-Metal superior Stock Leaves come in 3 diameters, are made in iron, can be ordered in other metals. Multi-Metal Custom Filter Units, fabricated in all weaves, sizes, shapes and metals are constant evidence of Multi-Metal's ability to meet successfully all your challenges in blue-print. Send us your specifications and ask about our helpful catalog.

★

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All Meshes
All Metals

Multi-Metal
WIRE CLOTH COMPANY, INC.
1350 Garrison Ave., New York 59, N. Y.

CHEM. & MET.

Weighted Index of Prices for CHEMICALS

Base = 100 for 1937

This month	108.9
Last month	108.9
April, 1944	109.5
April, 1943	108.8

CURRENT PRICES

The accompanying prices refer to round lots. Where it is trade custom to sell f.o.b. works, quotations are so designated. Prices are corrected to April 11.

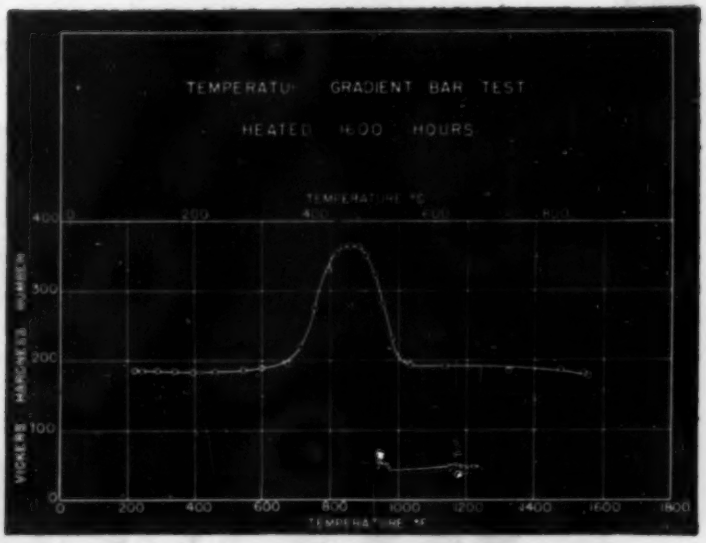
INDUSTRIAL CHEMICALS

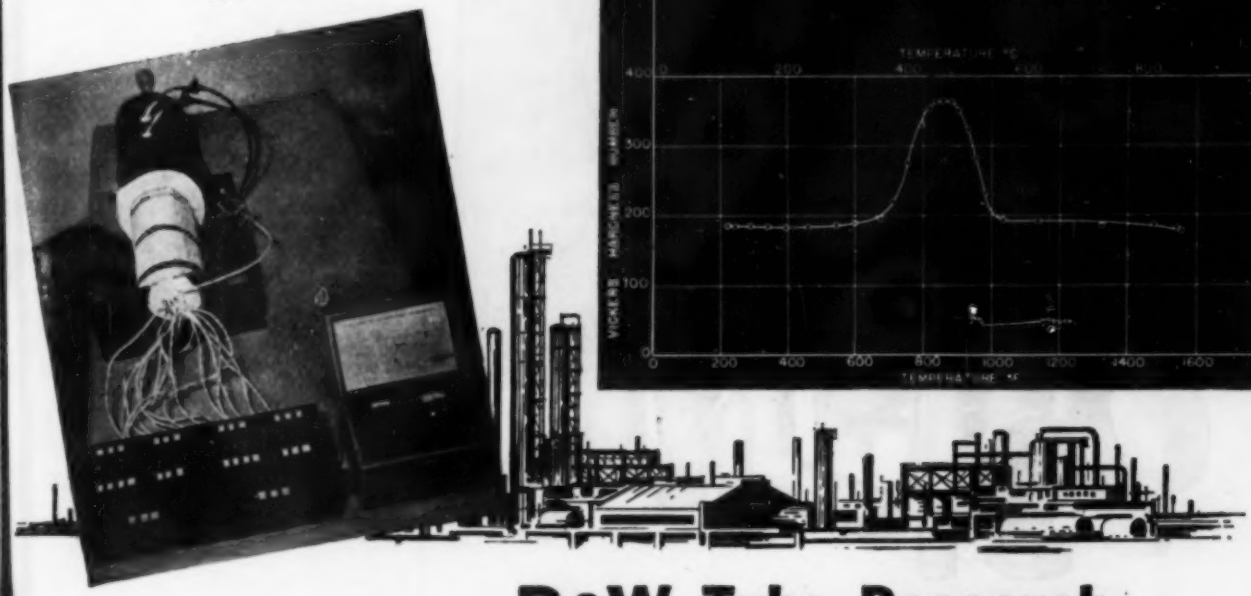
Acetone, tanks, lb	$0.07 –
Acid, acetic, 28%, bbl., 100 lb	3.38 – $3.65
Boric, bbl., ton	109.00 – 113.00
Citric, kegs, lb	.20 – .23
Formic, cbys., lb	.10½– .11
Hydrofluoric, 30%, drums, lb	.08 – .09
Lactic, 44%, tech. light, bbl., lb.	.073– .07
Muriatic, 18°, tanks, 100 lb	1.05 –
Nitric, 36°, carboys, lb	.05 – .05
Oleum, tanks, wks., ton	18.50 – 20.00
Oxalic, crystals, bbl., lb	.11½– .12
Phosphoric tech., tanks, lb	.04 –
Sulphuric, 60°, tanks, ton	13.00 –
Tartaric, powd., bbl., lb	.70½–
Alcohol, amyl	–
From pentane, tanks, lb	.13½–
Alcohol, butyl, tanks, lb	.10½– .15
Alcohol, ethyl, denatured, 190 proof	–
No. 1 special, tanks, gal., wks.	.50 –
Alum, ammonia, lump, bbl., lb	.04½–
Aluminum, sulphate, com., bags 100 lb	1.15 – 1.40
Ammonia, anhydrous, cyl., lb	.14½–
tanks, ton	59.00 – 69.00
Ammonium carbonate, powd. tech., casks, lb	.03½– .12
Sulphate, wks., ton	28.20 –
Amyl acetate, tech., from pentane, tanks, lb	.145–
Aqua ammonia, 26°, drums, lb	.02½– .04
tanks, ton	65.00 –
Arsenic, white, powd., bbl., lb	.04 – .05
Barium carbonate, bbl., ton	65.00 – 75.00
Chloride, bbl., ton	75.00 – 78.00
Nitrate, casks, lb	.09½– .11
Blanc fix, dry, bags, ton	60.00 – 70.00
Bleaching powder, f.o.b., wks., drums, 100 lb	2.50 – 3.00
Borax, gran., bags, ton	45.00 –
Calcium acetate, bags	3.00 –
Arsenate, dr., lb	.07½– .08
Carbide, drums, ton	50.00 –
Chloride, flake, bags, del., ton	18.50 – 23.00
Carbon bisulphide, drums, lb	.05 – .05
Tetrachloride, drums, gal	.73 – .75
Chlorine, liquid, tanks, wks., 100 lb	1.75 – 2.00
Copperas, bgs., f.o.b., wks., ton	17.00 – 18.00
Copper carbonate, bbl., lb	.19½– .20
Sulphate, bbl., 100 lb	5.00 – 5.50
Cream of tartar, bbl., lb	.37 –
Diethylene glycol, dr., lb	.14½– .15
Epsom salt, dom., tech., bbl., 100 lb	1.80 – 2.00
Ethyl acetate, tanks, lb	.11½–
Formaldehyde, 40%, tanks, lb	.032–
Furfural, tanks, lb	.09½–
Glaubers salt, bags, 100 lb	1.05 – 1.20
Glycerine, c.p., drums, extra, lb	.15½– .16
Lead:	
White, basic carbonate, dry casks, lb	.08½–
Red, dry, sck., lb	.09½–
Lead acetate, white crys., bbl., lb	.12½– .13
Lead acetate, powd., bag, lb	.11½– .12
Lithopone, bags, lb	.04½– .05
Magnesium carb., tech., bags, lb	.06½– .07
Methanol, 95%, tanks, gal	.58 –
Synthetic, tanks, gal	.24 –
Phosphorus, yellow, cases, lb	.23 –
Potassium bichromate, casks, lb	.10½– .11
Chlorate, powd., lb	.09½– .10
Hydroxide (c'stic potash) dr., lb	.07 –
Muriate, 60%, bags, unit	.53½–
Nitrate, bbl., lb	.05½–
Permanganate, drums, lb	.19½– .20
Prussiate, yellow, casks, lb	.16 –
Sal ammoniac, white, casks, lb	.0515–
Salsoda, bbl., 100 lb	1.00 – 1.10
Salt cake, bulk, ton	15.00 –
Soda ash, light, 58%, bags, contract, 100 lb	1.05 –
Dense, bags, 100 lb	1.15 –
Soda, caustic, 76%, solid, drums, 100 lb	2.30 – 3.00
Acetate, del., bbl., lb	.05 –
Bicarbonate, bbl., 100 lb	1.70 – 2.00
Bichromate, casks, lb	.07½–
Bisulphate, bulk, ton	16.00 – 17.00
Bisulphite, bbl., lb	.03 –

Long-Time Tests Predetermine Long-Time Service

(Right) Fig. 1. Hardness — Temperature Curve Obtained by B&W Gradient Bar Test.

(Below) Fig. 2. Special Set-Up Developed by B&W for Gradient Heating of Test Bars.





B&W Tube Research Tests High Alloy Steels' Behavior Through Their SERVICE RANGE

The Babcock & Wilcox Tube Company is continuously studying the behavior of highly alloyed steels under temperature environment so as to forecast utility and performance in high temperature applications. As a consequence, B&W may be expected to furnish accurate information on properties of ferrous metals for application in the newer oil refining processes and for other chemical process work, including production of raw materials for synthetic rubber.

In B&W's large, complete laboratories furnace equipment is utilized for long-time heating tests wherein changes in physical properties or alteration in structure and other effects of heating may be determined. Figure 2 shows a special set-up developed by B&W for gradient heating where a complete service range of temperatures may be covered. The test bar, after heating, is subjected to a careful survey at thermocouple locations for changes in hardness and structure. Aging or embrittlement temperature ranges may thus be precisely located and thereafter specific studies made to determine the effect of embrittlement on physical properties. Figure 1 shows a temperature-hardness curve obtained by the gradient bar test.

B&W seamless tubing is available in a complete range of alloy and stainless steels, thus meeting any refinery need. More and more tube users benefit by B&W's research and ability to match tubes to jobs without prejudice toward any particular type. Why not bring your tube problems to B&W?

B&W TUBES

ELECTRIC-RESISTANCE WELDED	SEAMLESS
Carbon steel grades	Complete range of carbon, alloy and stainless steels
Sizes: ¾ in. to 4 in. O.D.	Sizes: ½ in. to 8⅝ in. O.D.

THE BABCOCK & WILCOX TUBE COMPANY

WELDED TUBE DIVISION, ALLIANCE, OHIO — SEAMLESS TUBE DIVISION, BEAVER FALLS, PA.

B&W MAKES BOTH

TA-1507

Seamless and Drop-Forged Steel Products
To make a high quality steel product, the steel itself must be right. That is why Harrisburg makes its own alloy and carbon steels for special purposes. Thus Harrisburg products are right from the start; right because supervision begins with the pig and ends only at the point of shipment. The Harrisburg plant is equipped with three fifty-ton open hearth furnaces. One 2-high 32 inch Blooming and Slabbing Mill; Annual capacity — 100,000 tons.

H

HARRISBURG STEEL CORPORATION

Manufacturers of

Alloy and Carbon Steel

•

Seamless Steel Cylinders, Liquefiers, Pipe Couplings and Slush Pump Liners

•

Drop Forgings and Drop-Forged Steel Pipe Flanges

•

Coils and Bends

Harrisburg

STEEL CORPORATION · HARRISBURG, PENNSYLVANIA

CHEM. & MET.
Weighted Index of Prices for
OILS & FATS

Base = 100 for 1937

This month	145.8
Last month	145.8
April, 1944	145.2
April, 1943	146.0

Chlorate, kegs, lb.	.06½ -	.06½
Cyanide, cases, dom., lb.	.14½ -	.15
Fluoride, bbl., lb.	.07 -	.08
Hyposulphite, bbl., 100 lb.	2.40 -	2.50
Metasilicate, bbl., 100 lb.	2.50 -	2.65
Nitrate, bulk, 100 lb.	1.35 -	
Nitrite, casks, lb.	.06½ -	.07
Phosphate, tribasic, bags, lb.	2.70 -	
Prussiate, yel., bags, lb.	.09½ -	.10
Silicate, 40°, dr., wks., 100 lb.	.80 -	.85
Sulphide, bbl., lb.	.02½ -	
Sulphite, crys, bbl., lb.	.02½ -	.03
Sulphur, crude at mine, long ton	16.00 -	
Dioxide, cyl., lb.	.07 -	.08
Tin crystals, bbl., lb.	.39½ -	
Zinc chloride, gran., bbl., lb.	.05½ -	.06
Oxide, lead free, bag, lb.	.07½ -	
Oxide, 5% leaded, bags, lb.	.07½ -	
Sulphate, bbl., cwt.	3.85 -	4.00

OILS AND FATS

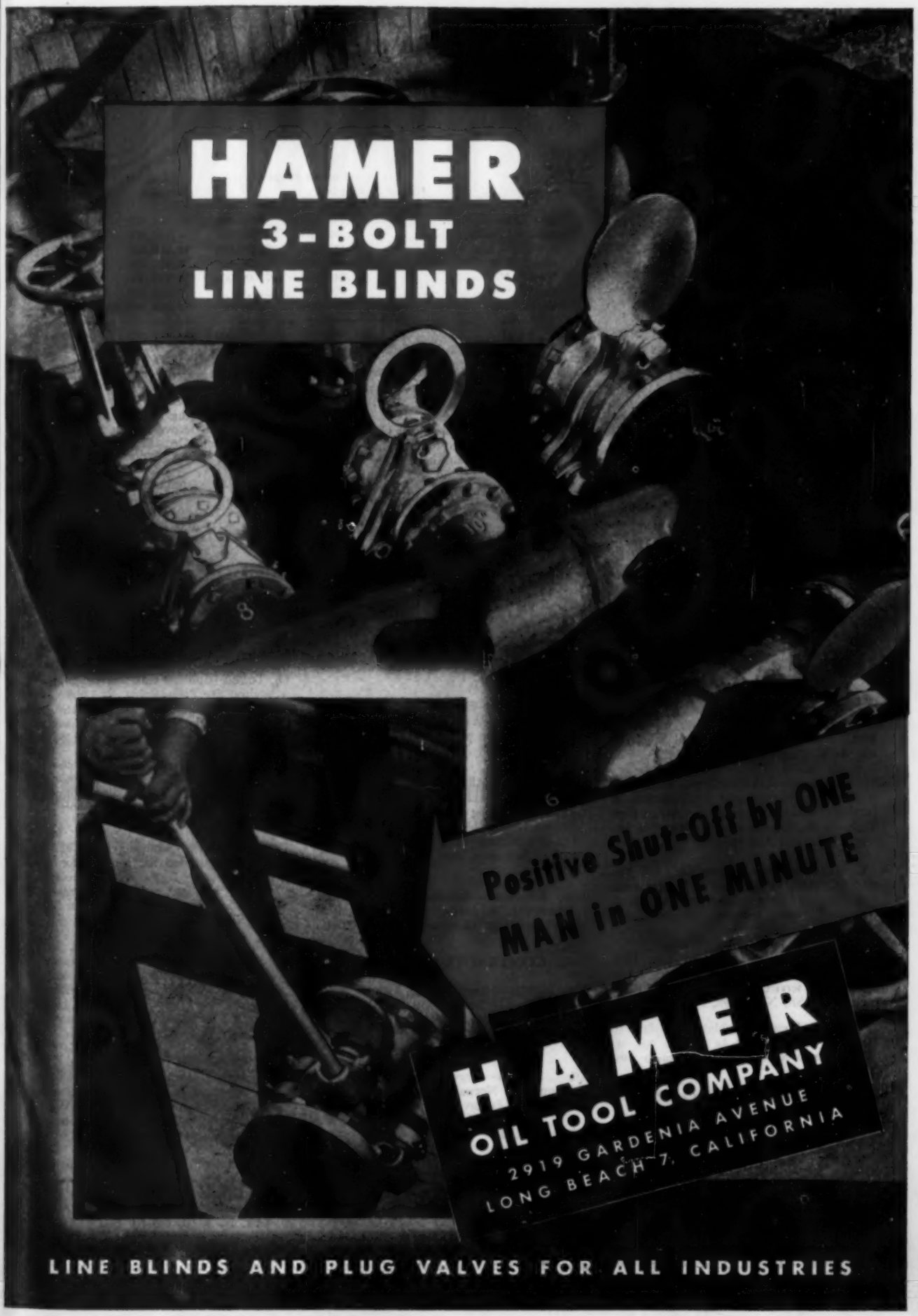
Castor oil, No. 3 bbl., lb.	$0.13½ -	$0.14
Chinawood oil, tanks, lb.	.38½ -	
Coconut oil, ceylon, dr. N. Y., lb.	.0885 -	
Corn oil crude, tanks (f.o.b. mill), lb.	.12½ -	
Cottonseed oil, crude (f.o.b. mill), tanks, lb.	.12½ -	
Linseed oil, raw, car lots, bbl., lb.	.155 -	
Palm, casks, lb.	.0865 -	
Peanut oil, crude, tanks (mill), lb.	.13 -	
Rapeseed oil, refined, bbl., lb.	nom.	
Soybean, tank, lb.	.11½ -	
Menhaden, light pressed, dr., lb.	.12½ -	
Crude, tanks (f.o.b. factory) lb.	.080 -	
Grease, yellow, loose, lb.	.08½ -	
Oleo stearine, lb.	.09 -	
Oleo oil, No. 1, lb.	.11 -	
Red oil, distilled, bbl., lb.	.12½ -	
Tallow extra, loose, lb.	.08½ -	

COAL-TAR PRODUCTS

Alpha-naphthol, crude, bbl., lb.	$0.52 -	$0.53
Alpha-naphthylamine, bbl., lb.	.32 -	.34
Aniline oil, drums, extra, lb.	.15 -	.16
Aniline, salts, bbl., lb.	.22 -	.24
Benzaldehyde, U. S. P., dr., lb.	.85 -	.90
Bensidine base, bbl., lb.	.70 -	.72
Benzoic acid, U. S. P., kegs, lb.	.54 -	.56
Benzol, 90%, tanks, works, gal.	.15 -	
Benzyl chloride, tech., dr., lb.	.23 -	.25
Beta-naphthol, tech., drums, lb.	.23 -	.24
Cresol, U. S. P., dr., lb.	.11 -	
Cresylic acid, dr., wks., gal.	.81 -	.83
Diphenyl, bbl., lb.	.15 -	
Diethylaniline dr., lb.	.40 -	.41
Dinitrotoluol, bbl., lb.	.18 -	.19
Dinitrophenol, bbl., lb.	.22 -	.23
Dip oil, 15%, dr., gal.	.33 -	.35
Diphenylamine, dr. f.o.b. wks., lb.	.60 -	
H. acid, bbl., lb.	.45 -	.50
Hydroquinone, bbl., lb.	.90 -	
Naphthalene, flake, bbl., lb.	.07 -	.07½
Nitrobensene, dr., lb.	.08 -	.09
Paracresol, bbl., lb.	.41 -	
Para-nitraniline, bbl., lb.	.47 -	.49
Phenol, U. S. P., drums, lb.	.10½ -	.11
Picric acid, bbl., lb.	.35 -	.40
Pyridine, dr., gal.	1.70 -	1.80
Resorcinol, tech., kegs, lb.	.75 -	.80
Salicylic acid, tech., bbl., lb.	.26 -	.30
Solvent naphtha, w.w., tanks, gal.	.27 -	
Tolidine, bbl., lb.	.96 -	.98
Toluol, drums, works, gal.	.33 -	
Xylol, com., tanks, gal.	.26 -	

MISCELLANEOUS

Casein, tech., bbl., lb.	$0.18 -	$0.24
Dry colors		
Carbon gas, black (wks.), lb.	.0335 -	.30
Prussian blue, bbl., lb.	.36 -	.37
Ultramarine blue, bbl., lb.	.11 -	.26
Chrome green, bbl., lb.	.23 -	.33
Carmine, red, tins, lb.	4.60 -	4.75
Para toner, lb.	.75 -	.80
Vermilion, English, bbl., lb.	2.75 -	2.80
Chrome, yellow, C. P., bbl., lb.	.16 -	.17
Gum copal, congo, bags, lb.	.09 -	.30
Manila, bags, lb.	.09 -	.13
Damar, Batavia, cases, lb.	.10 -	.23
Kauri, cases, lb.	.18 -	.60
Magnesite, calc, ton	64.00 -	
Pumice stone, lump, bbl., lb.	.05 -	.07
Rosin, H., 100 lb.	7.00 -	
Shellac, orange, fine, bags, lb.	.39 -	
Bleached, bonedry, bags, lb.	.39 -	
T. N. bags, lb.	.31 -	
Turpentine, gal.	.90 -	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OIL TOOL COMPANY
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LONG BEACH 7, CALIFORNIA
LINE BLINDS AND PLUG VALVES FOR ALL INDUSTRIES

NEW CONSTRUCTION

PROPOSED WORK

Calif., Vernon—Brunswig Drug Co., 501 North Main St., Los Angeles, is having plans prepared by A. C. Martin, Archt., 233 Higgins Bldg., Los Angeles, for the construction of a 2 story warehouse here. Estimated cost will exceed $500,000.

Conn., Naugatuck—Naugatuck Chemical Co., Elm St., is having plans prepared by Fletcher-Thompson, Inc., Engr., 211 State St., Bridgeport, for the construction of a 3 story, 45 x 60 ft. factory for Rubber Reserve Co., 811 Vermont Ave., N.W., Washington, D.C. Estimated cost $45,000.

La., Lake Charles—Cities Service Refining Corp., 70 Pine St., New York, N. Y., plans to construct a plant here. Project will be financed by Defense Plant Corp., Washington, D. C. Estimated cost $15,000,000.

La., McCoy—Defense Plant Corp., Washington, D. C., plans to construct a carbon black plant here to be operated by Cabot Carbon Co., 77 Franklin St., Boston, Mass. Estimated cost $1,040,000.

Mo., St. Louis—Defense Plant Corp., Washington, D. C., plans to construct a factory here for the production of battery cells for portable radios to be operated by National Carbon Co., 1447 Olesatha Ave., St. Louis. Estimated cost $200,000.

N. J., Linden—Main Chemical Supply Corp., 109 Prince St., New York, N. Y., plans to construct a 1 story, 100 x 140 ft. factory here. Nathan Siegler, 951 Broad St., Newark, Archt. Estimated cost $45,000.

N. J., Piscataway—Bakelite Corp., River Rd., is having plans prepared by Francisco & Jacobus, Archts., 511 Fifth Ave., New York, N. Y., for the construction of a factory. Estimated cost $63,000.

N. Y., Buffalo—Foster-Milburn Co., 468 Dewitt St., plans to construct a 1 story addition to its drug manufacturing plant. Estimated cost between $40,000 and $50,000.

N. Y., Buffalo—General Chemical Co., 1050 South Park Ave., plans to construct a laboratory and service building. Oscar Fisher, 154 Nassau St., New York, N. Y., Archt.

O., Fremont—Fremont Rubber Co., plans to construct a new plant to replace one recently destroyed by fire. Estimated cost $100,000.

Okla., Guymon—Cabot Carbon Co., 77 Franklin St., Boston, Mass., plans to construct plant buildings here. Project will be financed by Defense Plant Corp., Washington, D. C. Estimated cost $1,500,000.

Pa., Philadelphia—Barrett Div. of Allied Chemical & Dye Corp., Margaret and Bermuda Sts., Philadelphia, plans to construct six service buildings. Estimated cost $50,000.

Tex., Baytown—Humble Oil & Refining Co., Baytown, plans to construct a 1 story laboratory building. Estimated cost $45,000.

	Current Projects		Cumulative 1945	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	$45,000	$550,000	$2,045,000	$280,000
Middle Atlantic	303,000	385,000	4,407,000	11,407,000
South	16,440,000	10,293,000	16,980,000	10,743,000
Middle West	100,000	3,050,000	5,875,000	8,746,000
West of Mississippi	18,345,000	2,600,000	44,925,000	69,144,000
Far West	500,000	.....	3,200,000	3,660,000
Canada	6,250,000	500,000	7,265,000	1,100,000
Total	$41,983,000	$17,378,000	$84,697,000	$105,080,000

Tex., Houston—Shell Oil Co., Shell Bldg., plans to construct a new 100 octane gasoline manufacturing plant. Estimated cost $9,000,000.

Tex., Nederland—Defense Plant Corp., Washington, D. C., plans to construct an aviation lubricating plant here to be operated by Pure Oil Co., Port Arthur and Nederland. Estimated cost $5,500,000.

Tex., Seagraves—Defense Plant Corp., Washington, D. C., plans to construct a carbon black plant here to be operated by Columbian Carbon Co., 41 East 42nd St., New York, N. Y. Estimated cost $1,500,000.

Tex., Sunray—Continental Carbon Co., 27 Park Pl., New York, N. Y., plans to construct additional manufacturing facilities here. Project will be financed by Defense Plant Corp., Washington, D. C. Estimated cost $600,000.

Va., Martinsville—E. I. duPont de Nemours & Co., Inc., Wilmington, Del., plans to enlarge its nylon plant here. Estimated cost $400,000.

B. C., Port Alberni—Bloedel-Stewart & Welch, Ltd., 1411 4th Ave. Bldg., Seattle 1, Wash., is having plans prepared by H. A. Simons, Engr., 1331 Third Ave. Bldg., for the construction of a sulphate pulp plant here. Estimated cost $6,000,000.

Alta., Bitumount—Alberta Oil Lands, Ltd., Bitumount, is having plans prepared for plant buildings. Estimated cost $250,000.

CONTRACTS AWARDED

Ala., Montgomery—Wilbanks Tire & Recapping Co., 227 North Court St., has awarded the contract for the construction of a tire plant to A. Berney Jones, 409 Monroe St., at $42,700.

Conn., Norwalk—Norwalk Tire & Rubber Co., Winnipauk, Norwalk, has awarded the contract for a factory to E & F Construction Co., 94 Wells St., Bridgeport. Estimated cost $550,000.

Ill., Chicago—International Printing Ink, 2211 Elston Ave., has awarded the contract to remodel and construct 3 story, 58x99x177 ft. addition to plant and 30x45 ft. varnish plant to Avery Brundage, 11 South La Salle St. Estimated cost $350,000.

Ill., Ottawa—Inland Rubber Co., Ottawa, has awarded the contract for the construction of a factory, power plant and office, to Darin & Armstrong, 2041 Fenkell Ave., Detroit, Mich. Estimated cost $2,500,000.

Ky., Louisville—Park & Tilford Distillers, 35th and Tyler Sts., has awarded the contract for a 2 story feed recovery plant to Whittenberg Construction Co., 2214 South Floyd St. Estimated cost $250,000.

N. J., Belleville—Liquid Carbonic Corp., 1881 Broadway, New York, N. Y., has awarded the contract for a 1 story, 162x207 ft. warehouse to Walter Kidde Co., 140 Cedar St., New York, N. Y. Estimated cost $80,000.

N. M., Monument—Charles Enu Johnson Co., 10th and Lombard Sts., Philadelphia, Pa., has awarded the contract for design and removal construction of carbon black plant to United Engineers & Constructors, 1401 Arch St., Philadelphia. Estimated cost $1,850,000.

O., Toledo—Sun Oil Co., Sun Oil Bldg., 1608 Walnut St., Philadelphia, Pa., plans to construct an addition to its synthetic rubber plant. Work will be done by own forces and subcontracts. Estimated cost $200,000.

Pa., Philadelphia—Quaker Rubber Corp., Comly and Milnor Sts., has awarded the contract for a 1 story addition to its plant to Harry Gilb Co., 2515 Germantown Ave. Estimated cost $55,000.

Pa., Philadelphia—Schneider Bros., 912 Brown St., have awarded the contract for rebuilding their paper lacquering plant recently destroyed by fire to Wintz Bros., 1618 Sellers St. Estimated cost between $125,000 and $150,000.

Pa., Ruffsdale—Dillinger Distilleries, 12 South 12th St., Philadelphia, have awarded the contract for rebuilding distillery and grain storage buildings here recently destroyed by fire to Groomes Construction Co., Highland Ave., Springdale, Pa. Estimated cost $100,000.

Tex., Carthage—United Gas Corp., United Gas Bldg., Houston, will dismantle large recycling plant at Myrtis, La., and transport and reerect same at Carthage. Work will be done by force account and subcontracts. Estimated cost $750,000.

Va., Norfolk—U. S. Engineer, Norfolk, has awarded the contract for miscellaneous buildings at Radford Ordnance Works to Mason & Hanger Co., Inc., 500 Fifth Ave., New York, N. Y. Estimated cost $10,000,000.

B. C., South Westminster—Gypsum Lime & Alabastine Co. of Canada, Ltd., 509 Richards St., will construct a new plant using its own forces. Estimated cost $500,000.